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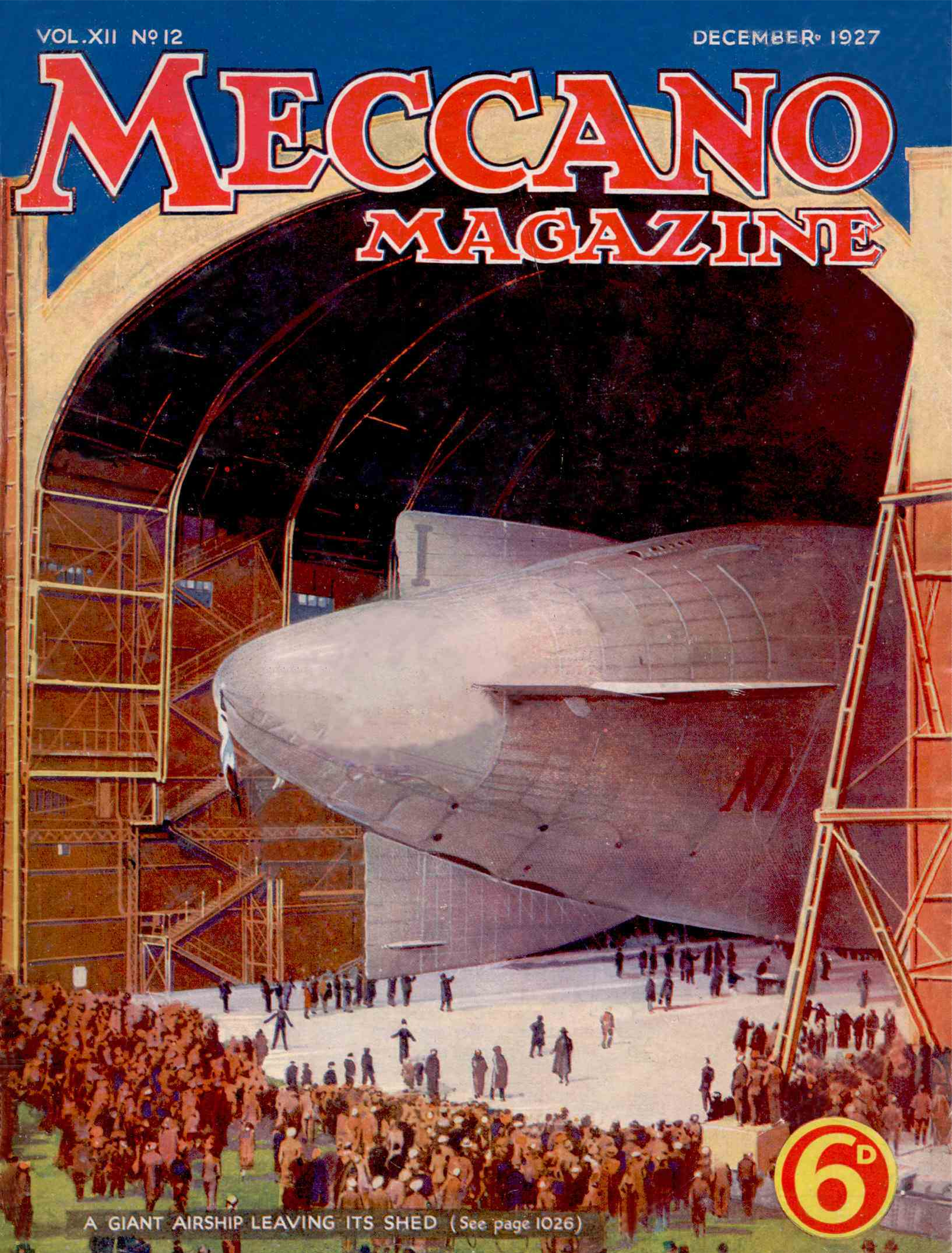
MECCANO MAGAZINE



A GIANT AIRSHIP LEAVING ITS SHED (See page 1026)

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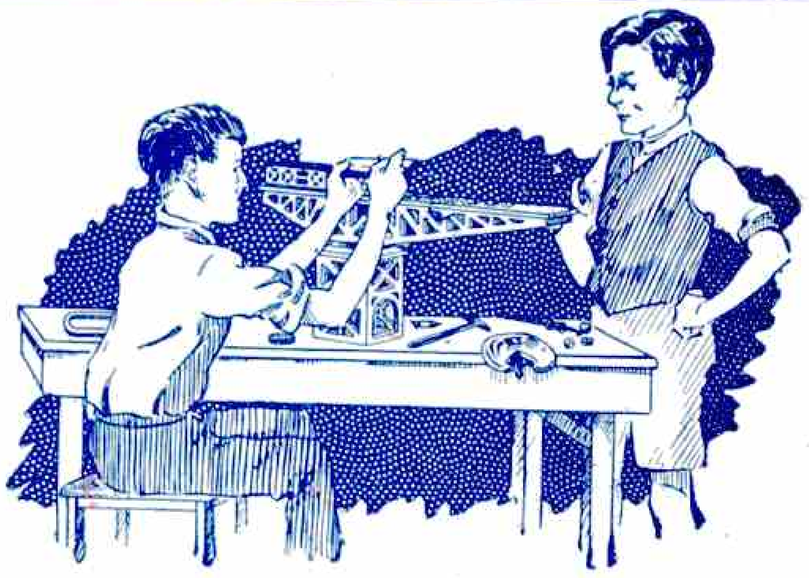

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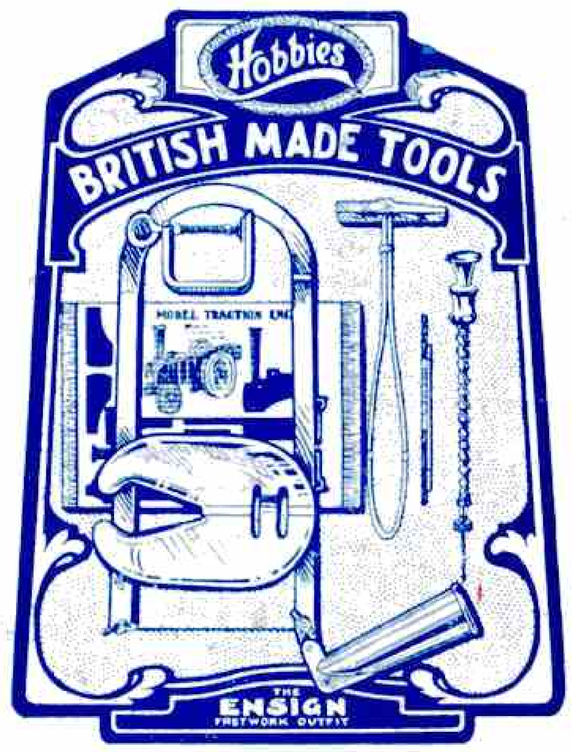

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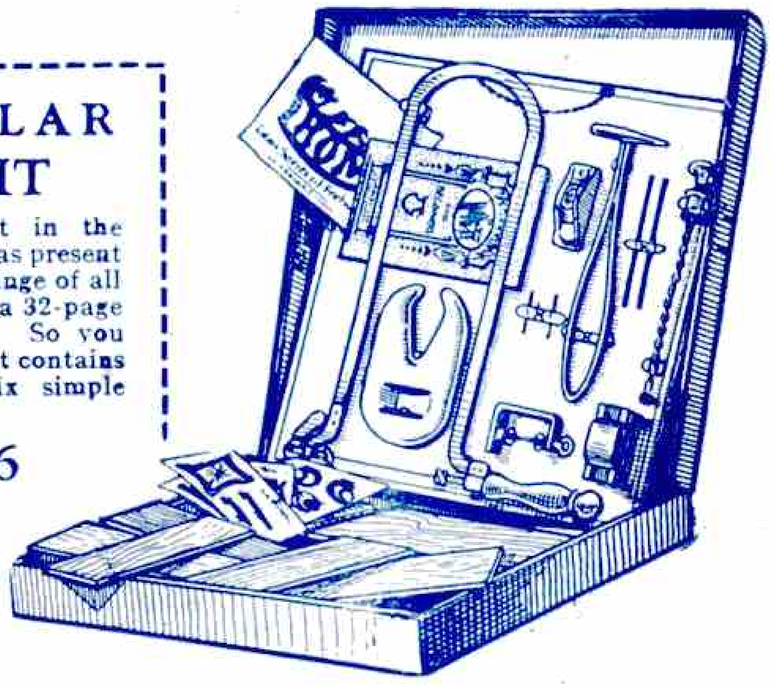

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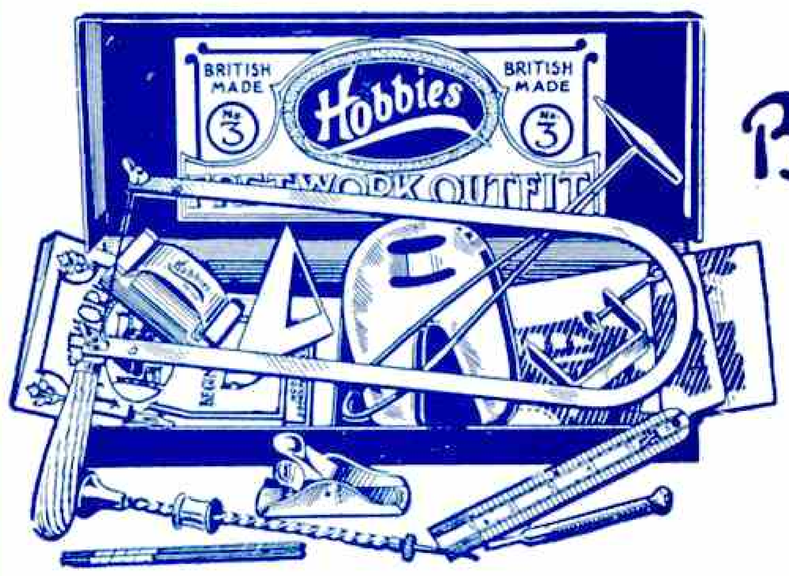

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MECCANO MAGAZINE

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With the Editor

Christmas Greetings to you All!

By the time this issue is in the hands of my readers, Christmas will be only some three weeks distant. I must therefore take this opportunity of sending my good wishes for a very Merry Christmas to all of you, otherwise if I wait until our next issue it will be too late. I shall be thinking of you all on Christmas morning and I hope that you will have a most enjoyable time over the holidays—and no ill effects!

I should like to take this opportunity, too, of sending my good wishes to all the fathers and uncles who read the "*M.M.*"—especially to those who have written encouraging letters to me during the past twelve months. I begin to think that we must number as many "grown-ups" as youngsters amongst our readers. In this connection I am reminded that one of my young friends recently wrote saying that he thought he qualified for membership of the famous "Henpecked Club," because his father always "collared" the "*M.M.*" immediately it arrived and did not release it until he had read every page! I certainly agree with him that modern parents are "awfully inconsiderate" in some ways! I am afraid there is only one remedy in cases of this kind—to purchase two copies instead of one!

If in doubt—write to the "Meccano Mag."!

Every succeeding week the contents of my mail bag seem to increase, and I am now receiving literally hundreds of letters every week from readers in all parts of the world. I should like to take this opportunity of saying how much I appreciate these letters and the helpful criticism that they bring, for it is only by this means that I am able to keep in touch with my readers and to know exactly what interests them. Often people say to me "How splendid the "*M.M.*" is! However do you manage to find so many interesting subjects?" The answer is quite simple, for really I am guided in the selection of subjects by the readers themselves through the letters they write.

Many of the letters I receive are of another kind—these ask for advice on a thousand and one subjects. It is one of my greatest pleasures to be able to help my readers in any difficulty, whether it be the all-important question of holding a *post mortem* on a goldfish, or that of giving advice about the choice of a career on leaving school! To new readers—of whom many thousands will be reading the "*M.M.*" this month for the first time—I would say that I welcome letters and want my readers to look to me for advice—if they cannot get such help elsewhere—and to cultivate the habit of "when in doubt, write to the "*M.M.*"! Those readers living abroad need not hesitate to write me in their own language—their letters will be translated here. We always reply to letters in the language in which they are written.

The "M.M." in 1928

As far as the "*M.M.*" itself is concerned, it is my constant endeavour to improve it, and the coming issues will be crowded with articles of even greater interest than those of the past. Railways still seem to occupy the most prominent place in the minds of most readers, and Mr. C. J. Allen will continue to write for us in 1928. His series of "*Famous Trains*," which has appeared in each issue during the last twelve months, has aroused considerable interest, and I hope shortly to announce that it has been possible to reprint these articles in some form or another. In the meantime I can say that Mr. Allen's articles during 1928 will deal with more famous trains—in the United Kingdom, in our Dominions and in foreign countries—and will form a splendid companion series to those articles that have already appeared.

The interest in aeroplanes is undiminished, and in this issue we commence the first of a series of articles dealing with the story of airships, which later will be followed by the Story of the Aeroplane, the object of the whole series being to describe man's conquest of the air. Our articles on "Exploring the Arctic," which in a recent Competition were voted to be the most popular of all our features, will conclude about the middle of the year. They will be followed by a further series, dealing with the exploration of the Antarctic.

An announcement of special interest to Hornby Train owners will be made in the spring and many other interesting articles are in active preparation. My readers may therefore look forward to a magazine of increasing interest and usefulness.

The Heart of Secondary Importance?

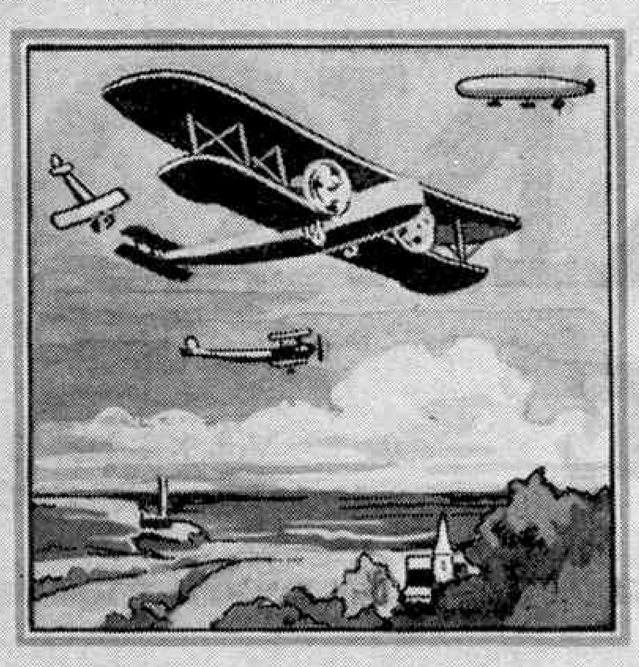
Although the human heart has always been regarded as being the central motive power of life, recent medical researches seem to show that we may come to regard the heart more as a distributing centre, the blood coursing through our veins in consequence of the activities of the other organs.

We know that the human body is a veritable "chemist's shop" in which the various organs and cells are either occupied in the building up of the complex organic substances that play as yet mysterious parts in life, or in removing others that are the waste products of the process of living. Chemicals of all kinds—acids, alkalies, salts, sugars, etc.—are concerned in this process. Dr. Martin Mendelsohn, Professor of Diseases of the Heart in the Berlin University, has suggested that the chief motive power for forcing the blood through the system is to be found rather in the activities of these cells than in the heart. Thus the heart is reduced almost to the position of a secondary organ and although it has always been regarded as pulsating with life, it now becomes a kind of junction through which the fuel and waste products are carried to and from the cells in the blood stream.

Dr. Mendelsohn calls attention to the fact that persons with weak hearts often live for long periods in spite of a handicap that could easily be fatal according to present ideas. He might also have cited the experiments in America and elsewhere in which the beating of the heart of an animal was stimulated by immersion in a solution of certain salts, causing the heart-beats to be continued for hours after death.

There is no doubt that the chemistry of living bodily processes holds many surprises in store for us. As yet the nature of these processes is very obscure, but the time is coming when efforts will be made to isolate the pure drugs that are being built up daily in the glands of the body and to discover their composition and the exact part they play. This, at least, is the opinion of Professor J. J. Abel, of the John Hopkins University, and he has led the way by building up one of these drugs ("adrenalin") from ordinary chemical materials, the product being identical with that made in certain cells in the body.

It is to the study of the chemistry of the body, too, that we must look for the discovery of cures for many diseases, and, what is even more important, for the introduction of methods of their prevention. This is the path along which progress must be made if diseases that at present work havoc are to be banished.



The Conquest of the Air

EARLY BALLOON ASCENTS

ONE of the oldest and cherished ambitions of man has been to conquer the air. Commencing with valiant but futile and frequently tragic endeavours to perform bird-like flights by wearing artificial feathered wings, the science of aeronautics has progressed steadily until the dream has been realised and flight has become an ordinary feature of everyday life.

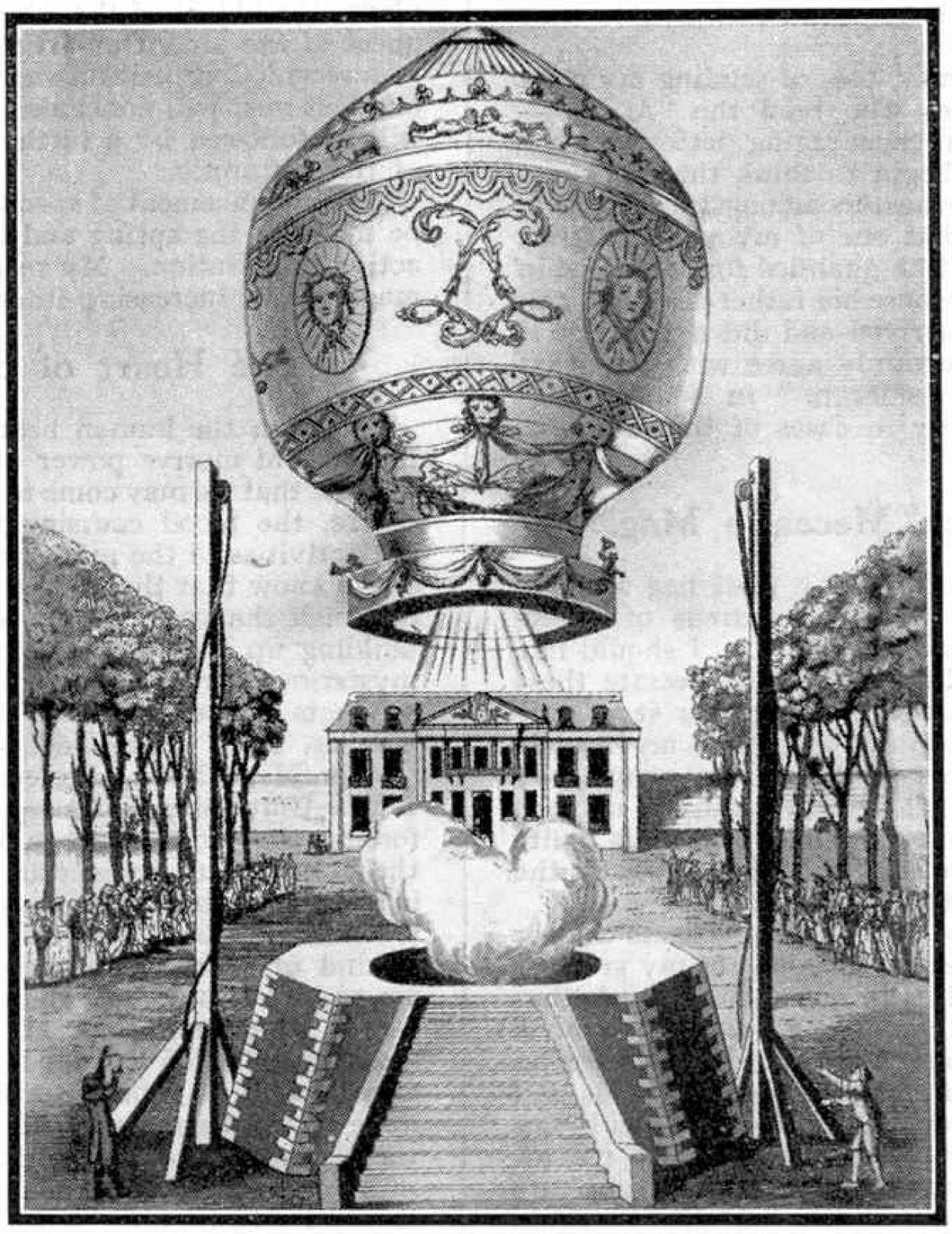
The story of this conquest is largely one of courageous pioneering. At a very early period investigation began to proceed on two distinct lines, one dealing with lighter-than-air balloons and the other with winged, heavier-than-air machines. In the present article we shall deal with the earlier stages in the evolution of balloons.

One of the earliest references to ascending into the air by means of a balloon occurs in the writings of Roger Bacon (1214-1294), the famous philosopher and chemist. Bacon suggested an aerial machine "composed of a large hollow globe of copper, or other suitable material, wrought extremely thin in order to have it as light as possible. It must then be filled with ethereal air of liquid fire and then launched from some lofty point into the atmosphere, where it will float like a vessel on water." From this extract it is evident that, although Bacon had arrived at some considerable degree of scientific understanding, his ideas in certain directions were somewhat crude!

About four centuries later the idea of ascending into the air by means of hollow metal balls was again propounded, this time by a Jesuit priest named Francisco Lana. Writing in 1670, Lana described a machine that he had devised which included four metal balls hollowed out and exhausted of atmosphere so as to render them specifically lighter than air. He estimated that the balls should be 1/225 in. in thickness and about 25 ft. in diameter. From beneath each ball was to be hung a rope and the lower ends of the four ropes were to be attached to a four-sided basket in the centre of which a tall mast was to be erected. This mast was designed to carry a cross-piece from which to hang a single sail that tapered to a point at the bottom where it was hooked to the edge of the basket.

The discovery made by Cavendish in 1766 that the gas hydrogen was only one-seventh the weight of atmospheric air really paved the way for the development of lighter-than-air balloons. This discovery led Dr. Black, another famous chemist, and an intimate personal friend of James Watt, to express the opinion two years later that a thin globe filled with hydrogen would rise and float in the air without difficulty.

Joseph Priestley, the discoverer of the gas oxygen, carried out some investigations along similar lines and published a work entitled "Experiments relating to Different Kinds of Air." One day in 1782 a French translation of this book came into the possession of Steven Montgolfier, a French paper manufacturer of Annonay, near Lyons, who also had studied chemistry; and on reading Priestley's comments the idea occurred to him that, by allowing hot gases to pass upward into a bag constructed of some very light material, this, when filled, would immediately ascend. Montgolfier was away from home at the time and he wrote to his younger brother Joseph instructing him to "prepare a supply of taffeta and cordage and you shall sæe the most astonishing thing in the world." Upon arriving home later Steven confided his discovery to Joseph, who became equally excited, and the two decided to commence experiments immediately.



First ascent of man in a free balloon. M. Pilâtre de Rozier and the Marquis d'Arlandes ascending in a Montgolfier balloon at Paris, 21st November, 1783

The first balloon made by the brothers was of paper and had a capacity of about 700 cu. ft. It had an opening at the bottom and was held over a fire of burning straw until it became full of hot air. It was then released and it immediately ascended to a height of about 1,000 ft. This initial success greatly increased the enthusiasm of the Montgolfiers and they immediately set to work to construct a larger balloon. They did their utmost to keep their experiments secret, but in spite of their efforts sensational rumours got about that they were engaged upon an invention in which strange gases would send "a great weight into the heavens which would rise and float about amidst the clouds and sink to earth at human bidding!"

The second balloon was completed by June, 1783, and the Montgolfiers announced that a public demonstration would be given in the market place of Annonay on the 5th of that month. On the appointed day the wide market place was thronged with a vast crowd of people who had come from far and near. The centre of the square was mostly occupied by a huge mass of linen fixed to a wooden frame, the whole contrivance weighing about 300 lb. Presently it was announced that this vast balloon was to be filled with gas and that it would then rise to the clouds. Very few of the spectators really believed this statement, but everybody was keenly interested and all eyes were concentrated upon the gigantic bag.

A fire of bundles of chopped straw was lighted in a small receptacle that later was seen to be suspended beneath the balloon,

and to the amazement of the people the bag gradually unfolded and at length assumed the shape of a huge pear approximately 35 ft. in diameter and containing 200 cu. ft. of hot air. Soon a signal was given, the balloon was released and it rose rapidly. In ten minutes it attained a height of about 600 ft. and then, carried by the wind, it drifted across country for a distance of nearly a mile and a half before coming down to earth.

The news of the successful flight caused a great sensation in Paris, and the Academy of France, to whom the Montgolfiers had sent the details of their earlier experiments, requested them to repeat the Annonay performance. The inventors were unable to comply with the request immediately, however, and the Academy, being too impatient to delay further investigation, promptly commissioned M. Charles, Professor of Physics at the Conservatoire in Paris, to construct a balloon and carry out experiments. Charles declared his intention of filling his balloon with hydrogen, and as this was expensive to manufacture, a public subscription was opened to provide the necessary funds.

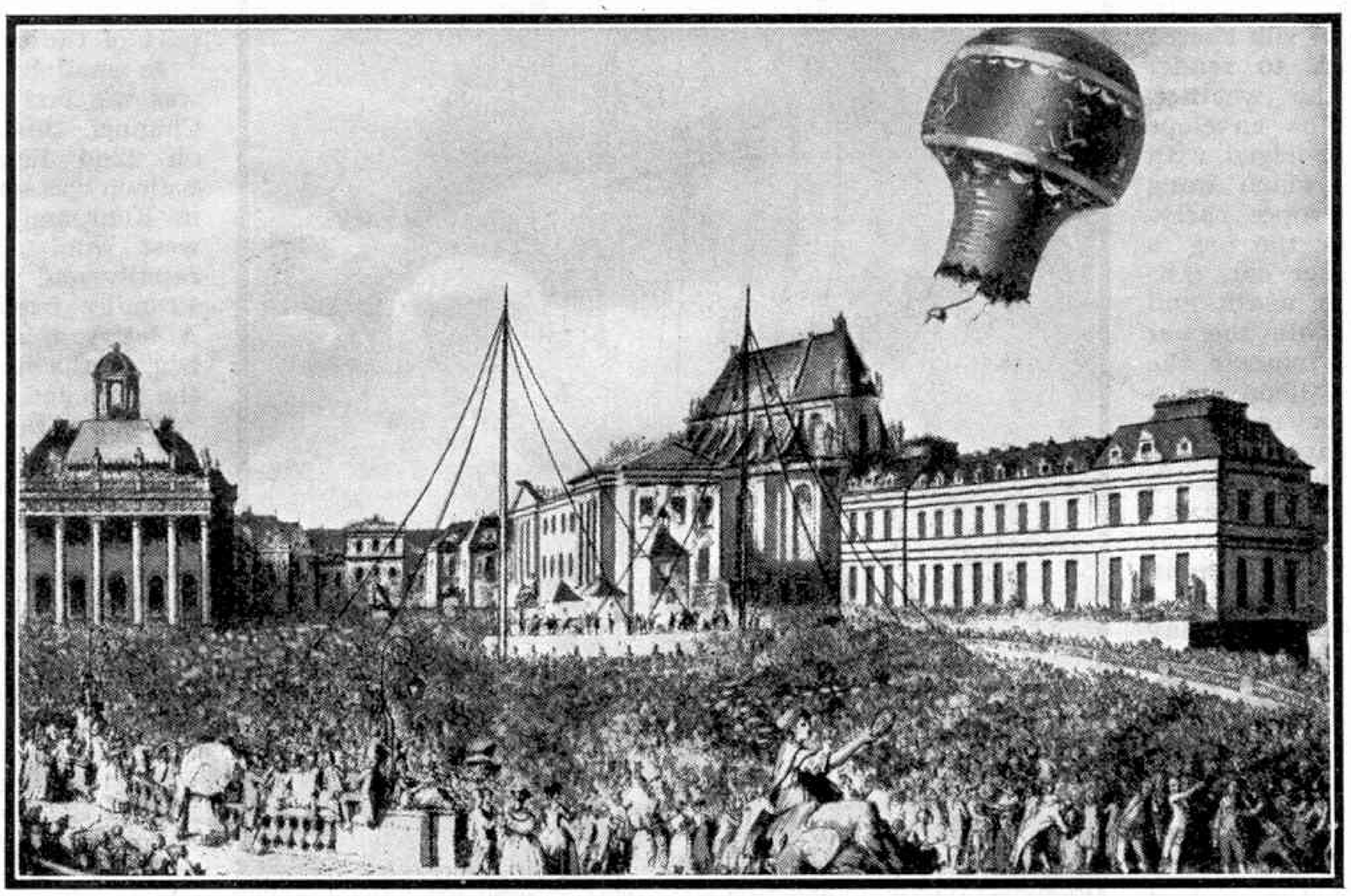
The globular envelope of the balloon was made of a kind of lustrous silk called "lutestring," which had been dipped in a solution of india-rubber. The hydrogen was obtained from the action of dilute sulphuric acid on iron filings and 1,000 lb. of filings and 498 lb. of acid were used before the envelope was sufficiently filled with gas. The filling was commenced on 23rd August, 1783, in Place des Victoires, Paris, but proved so difficult that after a time operations were suspended for an examination of the balloon to be made. It was then discovered that a stop-cock had been left open! The balloon was thereupon emptied and filling was postponed until 26th August, when on a second attempt it was filled sufficiently to cause it to rise to a height of 100 ft., to which it was restricted by ropes.

The crowd of people that assembled to witness these operations became so vast that for the safety of the balloon it was decided to remove it during the night of the 26th to Champs de Mars, about two miles distant, and it is doubtful if Paris ever witnessed a more weird episode than that night journey of the huge balloon. An eye-witness declared that "no more wonderful scene could be imagined than the balloon being thus conveyed, preceded by light torches, surrounded by a cortege, and escorted by a detachment of foot and horse guards; the nocturnal march, the form and capacity of the body carried with so much precaution; the silence that reigned, the unseasonable hour, all tended to give a singularity and mystery truly moving to all those who were acquainted with the cause. The cab-drivers on the road were so astonished that they were impelled to stop their carriages and to kneel humbly, hat in hand, while the procession was passing."

The removal of the balloon was quickly discovered by the public, however, and from an early hour on the 27th August great crowds thronged the roads leading to the Champs de Mars, which throughout the day was lined with troops. At 5 p.m. amid a downpour of rain the firing of a gun announced that all was ready, and a few moments later the huge silk balloon, released from bondage, shot up into the air. So swiftly did it ascend that within eight minutes it attained a height of 3,123 ft. and vanished above the clouds. A rent developed in the silk cover, however, with the result that most of the gas escaped and the balloon came down in a field near the village of Gonesse, 15 miles from Paris.

The sight of the strange apparition caused the utmost terror among the villagers, many of whom believed it to have come down from another world! The scene may well be imagined from the quaint phrases of an old account of the episode: "A small crowd gained courage from numbers and for an hour approached by gradual steps, hoping meanwhile the monster would take flight. At length one, bolder than the rest, takes his gun, stalks carefully within range, fires, witnesses the monster shrink, gives a shout of triumph, and the crowd rush in with flails and pitchforks. One tears what he thinks to be the skin and so causes a poisonous stench; again all retire. Shame, no doubt, now urges them on and they tie the cause of alarm to a horse's tail, who gallops across country tearing it to shreds."

On 12th September, 1783, Joseph Montgolfier gave a demonstration of ascents with one of his balloons in Paris. The exhibition was repeated at Versailles a week later when the first passenger flight ever made by means of a balloon was carried out. The passengers who had this distinction were a cock, a dog and a sheep, and the historic flight was made in the presence of Louis XVI, the Queen and Court, and a vast crowd of people.



First passenger flight in a balloon. The ascent of a cock, a dog and a sheep in a Montgolfier balloon at Versailles, 19th September, 1783

Ten minutes after the fire was lighted in the receptacle beneath the balloon envelope, the latter was entirely filled with hot air. The restraining ropes were then cut and in spite of the weight of the wicker cage suspended beneath it the balloon rose to a height of roughly 1,440 ft. After eight minutes aloft it descended again, falling so gently as to merely bend the branches of the trees on which it came to rest. The rope upholding the cage was cut, however, and the cage reached ground somewhat suddenly. On examination of the inmates it was found that the cock had an injured wing, but later it was found that this had been caused by a kick from the sheep shortly before the ascent of the balloon.

This momentous flight led to much speculation as to the ability of balloons to convey human beings through the air, but no one seemed prepared to risk the first flight. King Louis regarded such a venture as too perilous, but to end the controversy he commanded that two criminals sentenced to death should be sent up in a balloon. The idea of the distinction of having performed this pioneer feat being acquired by two criminals was so repulsive to a young man named Pilatre de Rozier that he undertook to make a flight if the royal decree could be withdrawn. His friend, the Marquis d'Arlandes, at once volunteered to accompany him, and was successful in persuading Louis to consent to this change of plan.

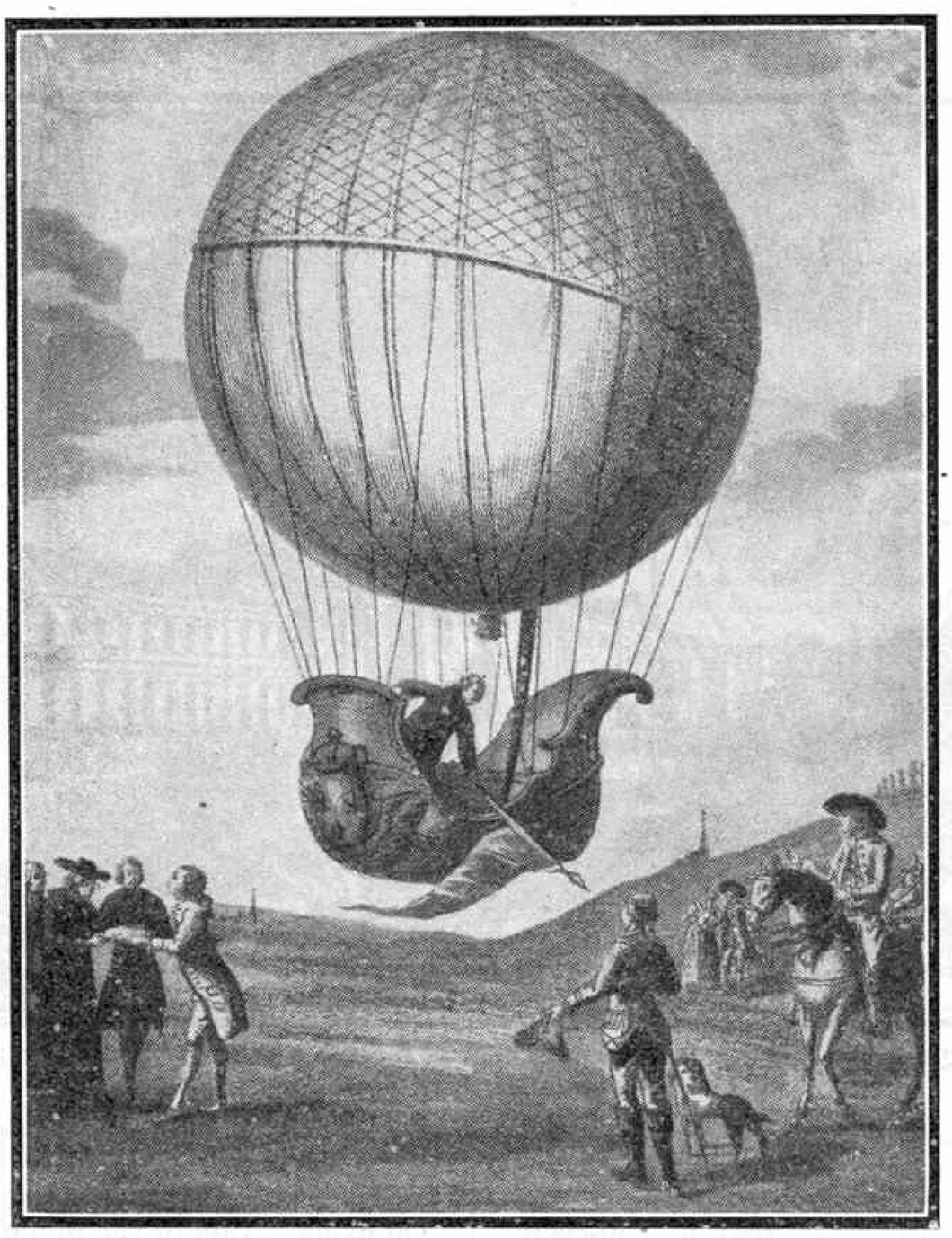
A large hot-air balloon of 100,000 cubic feet capacity, externally resplendent with many fantastic designs and having a gallery around the base, was specially made by Steven Montgolfier. When completed it was conveyed to a garden in the Fauberg St. Antoine, Paris, where it was inflated on 15th October, 1783. De Rozier then made several trial ascents in the balloon while this was held captive. When let out to the full the balloon was 84 ft. above the ground, and on one occasion de Rozier prevented it from sinking to earth for almost five minutes by replenishing the fuel of wool and straw in the small grate.

Preparations were next made for a definite flight on the 21st of the following month and the balloon was removed to the park of La Muette, a Royal Palace in the Bois de Boulogne, Paris. At a few minutes past noon on the appointed day the silk envelope was filled with hot air and de Rozier and the Marquis d'Arlandes climbed into the gallery and took up positions at opposite sides in order to preserve the balance of the machine. A start was then made, but the wind prevented the balloon from rising vertically and the ropes, straining upon one side, made several large

rents in the silk. The balloon was therefore pulled down again and deflated. Two hours later, the damage having been repaired and the bag refilled, a second ascent was made, and the balloon rose to a height of 3,000 ft. After a successful flight of about 20 minutes' duration, during which Paris was crossed, the balloon was brought to earth in a suburb of the city.

While Montgolfier's hot-air balloon was making history, Charles was quietly engaged in improving his hydrogen-filled balloon. Two brothers of the name of Robert had become greatly interested in Charles' experiments and they invited him to assist them to construct a balloon according to his principles. The scheme was advertised in a Parisian paper on 19th November, 1783, and the public were invited to subscribe towards the cost of the enterprise. The balloon when constructed was spherical in shape, of 27½ ft. diameter, and made of silk coated with resinous varnish to render it impervious to the weather. The upper half of the envelope was encased in a net edged with a stout rope from which hung a number of other ropes carrying, a few feet below the bag, a quaintly shaped wicker car, 8 ft. in length by 4 ft. in width and weighing 130 lb. Within the car was a barometer to indicate the rise and fall of the balloon and a supply of ballast for regulating buoyancy. In anticipation of a long flight the aeronauts placed a supply of provisions and extra clothing in the car. An important innovation was a valve made in the envelope and operated by a string, by means of which any excess gas could be allowed to escape.

The ascent was made on 1st December, 1783, from the Tuilleries Gardens, Paris and, like previous balloon exhibitions, was witnessed by a great crowd of people. In fine weather the balloon, with Charles and one of the Robert brothers in the car, rose rapidly to a height of 1,800 ft. and drifted across country at a speed of 15 m.p.h. A group of enthusiastic horsemen on land endeavoured to keep pace with the balloon but were soon left behind. After 1¼ hrs. in the air the balloon descended safely in a field near Nesle, some twenty-seven miles distant from Paris.



M. Charles re-ascending in his hydrogen filled balloon at Nesle, after M. Robert had alighted from the balloon car, 1st December, 1783

Robert then got out of the car, but as there was still a large quantity of gas in the envelope Charles resolved to risk a solo flight and requested the villagers holding the balloon ropes to let go. As a result of the lightened load the balloon shot up into the air with great rapidity and reached the record height of 9,300 ft. It then commenced to descend swiftly, but by throwing out some of the ballast Charles slowed down the pace and landed safely 35 minutes later in a ploughed field three miles from where he had re-ascended. King Louis awarded Charles a pension of £200 in recognition of his courage and enterprise.

The successful pioneer work of the Montgolfier brothers and Charles created a great vogue in France for ballooning, and in time it became a general sport. Captive balloons were used by the military for aerial observation work but free balloons were not adopted for some time, their great disadvantage being that they were at the mercy of the wind. The endeavour of various inventors to overcome this difficulty by devising some sort of steering gear brought about the development of the airship, the story of which we shall relate in subsequent articles.

In England and in America isolated attempts at balloon construction were made during 1783. In America two scientists named Hopkins and Rittenhouse, who had heard of de Rozier's successful pioneer work, constructed a machine consisting of 47 small hydrogen-filled balloons from which was jointly suspended a cage. In England first honours went to an Italian named Count Zambeccari, who in November, 1783, constructed a balloon in London. The balloon was made of oiled silk, beautifully gilded, was 10 ft. in diameter, weighed only 11 lb. and was three-quarters filled with hydrogen. On the 25th of the month the balloon was sent up from the Artillery Ground in the presence of many thousands of spectators. Attached to it was a small tin box containing direction for anyone who should find the balloon, which ultimately descended near Petworth, in Sussex, 48 miles from London, having travelled at a speed of nearly 20 m.p.h.

An event of particular interest occurred in the following year when on 19th January there ascended from Lyons a Montgolfier balloon of record size and carrying the record number of seven passengers, among whom were Joseph Montgolfier and de Rozier. The balloon is said to have been more than 100 ft. in diameter, roughly 130 ft. in height, and of more than 500,000 cubic feet capacity. It took 17 minutes to fill with hot air by means of a fire of burning straw and when filled it rose to a height of 3,000 ft., descending after 15 minutes as the result of a rent in the upper part of the envelope.

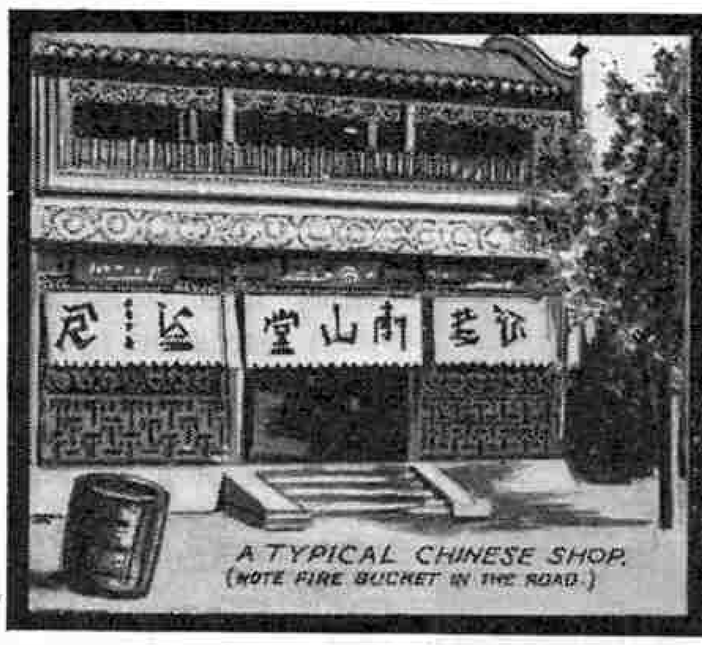
A small hydrogen-filled balloon was the first to cross the English Channel, this feat being achieved on 22nd February, 1784. The balloon was sent up from Sandwich in Kent and, carried by a north-west wind, crossed the Channel rapidly and was picked up about 12 miles from Lille, in Flanders. A letter attached to the balloon begged the finder to communicate the time and place it was found to "William Boys at Sandwich."

The success obtained with balloons won the admiration of a Frenchman named Jean Pierre Blanchard, who for several years had been experimenting with winged machines to navigate the air. He decided to combine the two, and in due course he constructed a hydrogen balloon 27 ft. in diameter and suspended beneath it by means of ropes a small car equipped with two wings and a rudder. Above the car and beneath the balloon envelope he rigged up a huge umbrella, the idea of which was to prevent the car and its cargo from crashing to earth if the balloon should burst. This device thus served a purpose identical with that of the modern parachute.

On 2nd March, 1784, Blanchard ascended in his balloon from the Champ de Mars, Paris, but owing to a leak in the envelope the balloon descended suddenly after having risen only a short distance. The car was severely jolted, and a Benedictine monk who had accepted Blanchard's invitation to make the aerial journey, decided not to risk his life further and clambered out of the car! Undismayed by the mishap, Blanchard repaired the envelope and prepared to re-ascend.

As the balloon was about to be released a young man suddenly jumped into the car and declared his intention of accompanying Blanchard. The latter objected, and the man promptly drew his sword and, in the course of brandishing it excitedly, wounded the aeronaut in the wrist. The intruder was ultimately removed by force and handed over to the police. The balloon was then released and, rising quickly, was carried by the wind over the River Passy. Then the breeze died away for a time and the balloon remained stationary in mid air, in spite of all Blanchard's efforts to move it onward by means of the wings and rudder. At length the balloon drifted back again over the river and ultimately descended at Billancourt, near Sevres. On the 18th July, Blanchard made a further ascent in the same balloon, this time from the barracks at Rouen, at 5.15 p.m., and took up one passenger. After an aerial voyage of 1¾ hrs. the balloon descended near Grandcour, 45 miles from Rouen. It was roped down but was not deflated until the following day.

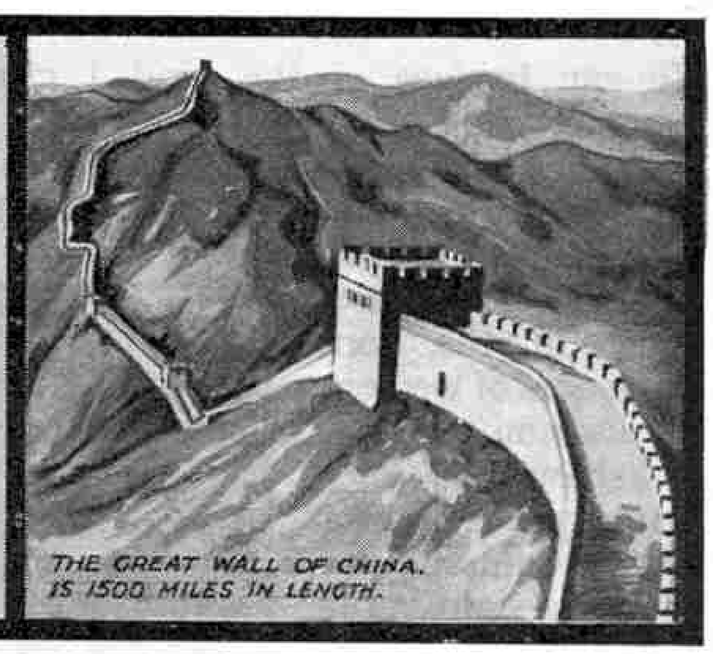
It was not until 27th August of the same year that the first balloon passenger flight was carried out in Great Britain. This was accomplished by a Mr. Tytler, who ascended from the Comely Gardens, Edinburgh, in a balloon he had constructed on the Montgolfier principle. The balloon did not carry any fuel, however, and in consequence descended as the hot air in the envelope cooled.



MY TOUR ROUND THE WORLD

by

FRANK HORNBY



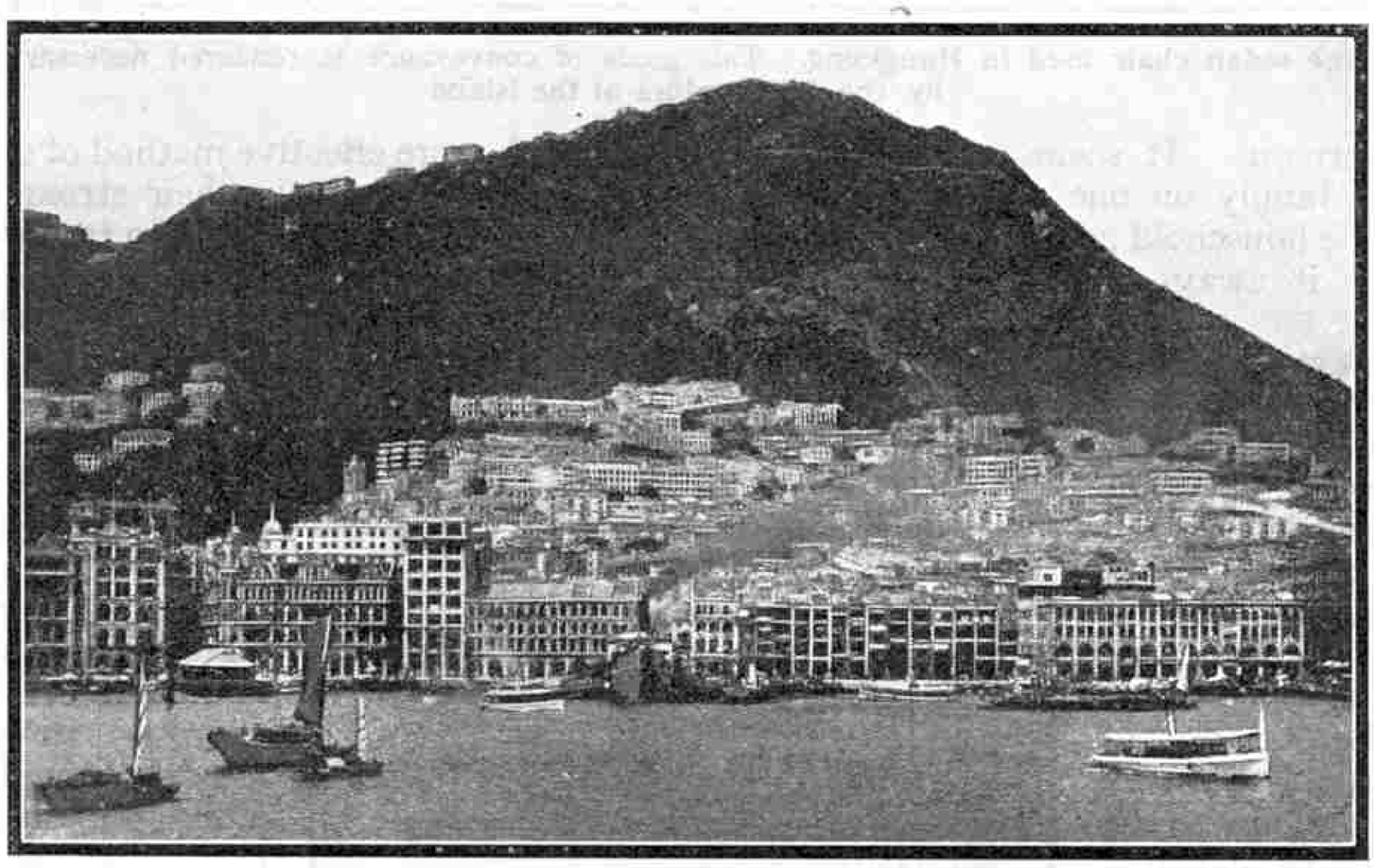
V. Shanghai to Hongkong. Pirates of Bias Bay. The River Dwellers at Canton.

LAST month I described my journey from Tientsin across the Yellow Sea to Shanghai. This large and important city has become well known to everybody since British troops were despatched thither to protect the foreign settlements from possible attack by Chinese troops.

In appearance I found Shanghai more like a European city than an oriental one. Along the river front stretches a splendid promenade, called the Bund, with grass lawns, public gardens, and a red clock tower. The roads and streets are well kept, the traffic is regulated by Sikhs and Chinese policemen, and the buildings are large and stately. The large number of English people engaged in the trade and commerce of the port is reflected in the existence of numerous golf and cricket clubs and a racecourse. Actually I think that there are more nationalities represented in Shanghai than in any city of the world. Most of the people I saw as I walked along the streets were, of course, Chinese, but natives of Japan, Malaya, India, Burma and Ceylon may easily be picked out, along with Europeans of different countries. I even saw a negro, but I do not think there are many in the city.

There are many interesting places within reach of Shanghai, but to my great regret it was impossible to visit them. At the time of my stay there the victorious Cantonese armies were approaching the city and it was not safe to travel far on the railway. This was very disappointing indeed, as I greatly wished to travel up the great Yangtse River. Quite apart from a desire to see the many typical and historical Chinese towns in its valley—particularly Nanking, an ancient Chinese capital, and Hankow, the most important commercial town in China—I should have liked to study the countryside that has supported such a teeming population for many centuries.

The Yangtse Valley is the chief rice-growing district. The importance of this crop may be gauged from the fact that, although some 4,000,000 tons of rice are grown annually in China, the demand is so enormous that it is necessary to import large quantities from other countries. The tilling of the rice fields here and in other parts of China is very primitive, as it is in Japan, but one thing that I learned when looking into the subject suggested that the oriental rice growers were perhaps right in sticking to their primitive methods. This was that modern agricultural machinery is liable to cut through the hard-beaten earth under the mud of the rice fields and thus allow the all-important water to sink into the soil itself.



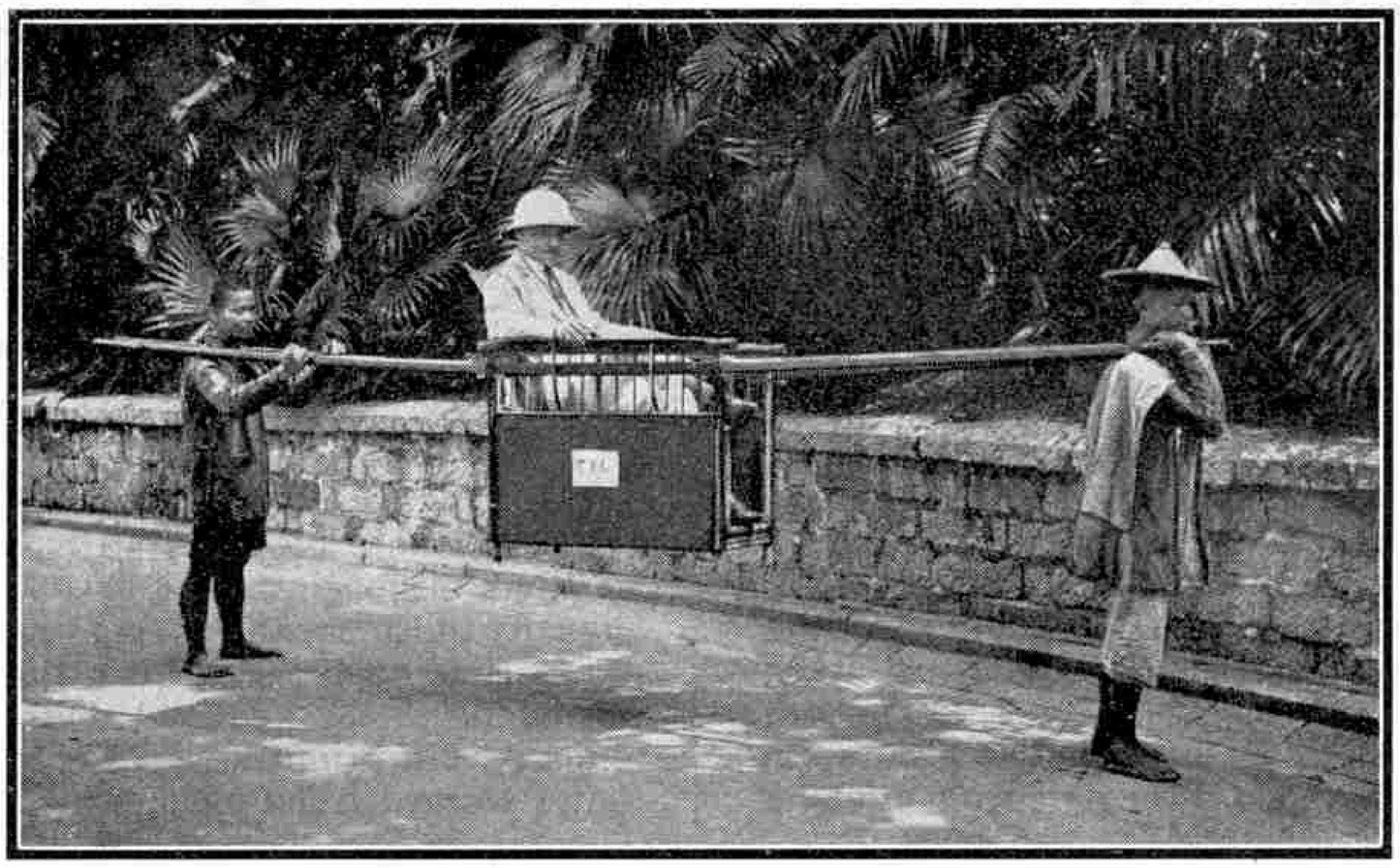
**The water front at Victoria, Hongkong.
Behind is the Peak up which the funicular railway runs**

One interesting experience I had while in Shanghai was a visit to the native city. This is situated to the south of the European settlements and is surrounded by a wall that is rapidly being demolished. It is a most congested district, the main thoroughfares being scarcely wide enough for two rickshaws to run abreast. A long street running outward from the centre of the city is the best place in which to find the shops that sell many curios that one naturally wishes to buy in China. I wandered through the town taking every opportunity of seeing the various industries carried on by the inhabitants. The majority of the shops were open to the street and in them the natives were very busy. I was particularly fascinated by the shops in which jade, bone, metal, wood and ivory were carved. Most of this work was done beautifully, and to my surprise I noticed that children who were scarcely more than babies were working side by side with grown-ups!

At another place was a Chinese tea-room situated in the centre of a large pond and approached by a series of zig-zag bridges, which I was led to believe was the original of the design of the willow-pattern china.

Zig-zag bridges of the kind I crossed here are very common in China, as they are supposed to baffle the approach of evil spirits.

Transport in the city is less primitive than in most Chinese towns, and Shanghai possesses most of the conveniences of western civilisation. The rickshaw is very largely used, and a very common and amusing sight is the Chinese wheel-barrow. This has a large platform and an enormous wheel that projects through the middle. A passenger will sit on one side of the wheel and place his luggage on the other, making it look like an Irish jaunting car without a horse! The loads carried in these vehicles are enormous. It seems quite easy to accommodate a whole family on one wheel-barrow, in addition to some of their household goods, and one coolie will cheerfully trundle it away, no matter how large the load.

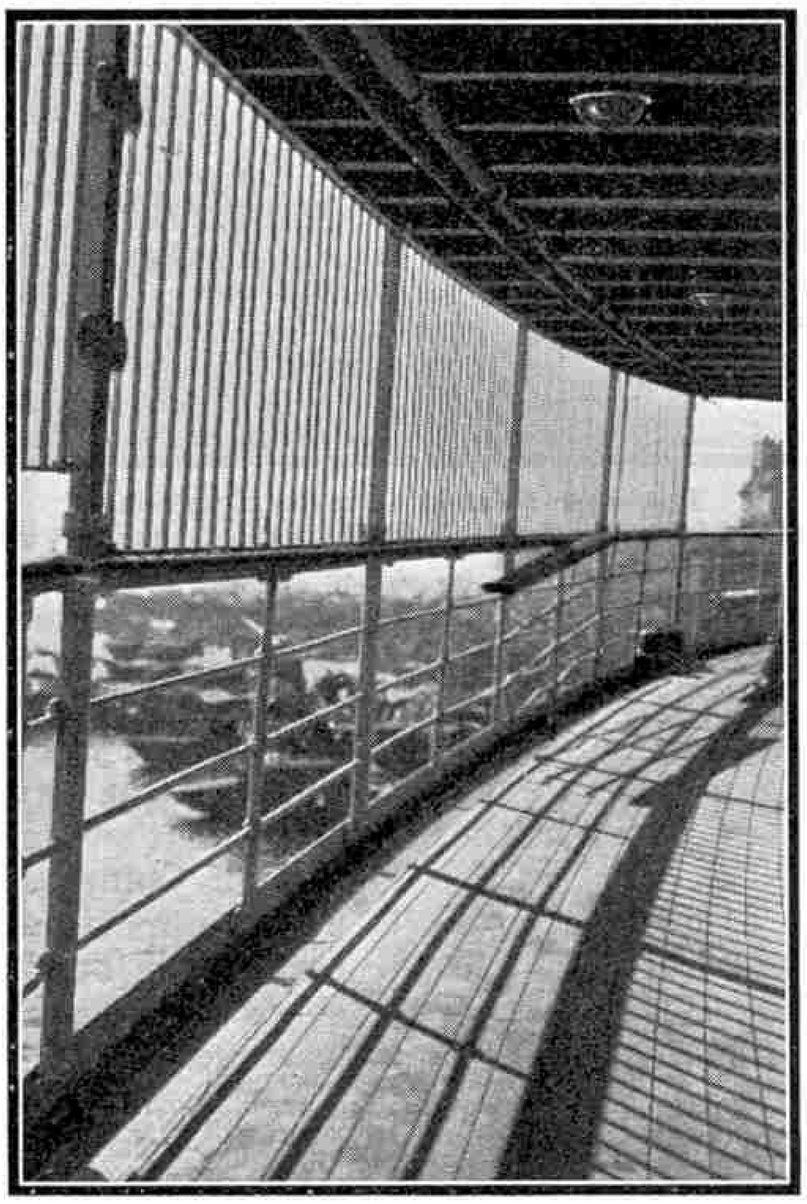


The sedan chair used in Hongkong. This mode of conveyance is rendered necessary by the hilly nature of the island

From Shanghai I took steamer for Hongkong. We were now approaching the chief hunting ground of pirates, as I was reminded when I saw that the central portion of the steamer was guarded by the iron bars seen in the photograph on this page. To a certain extent this made the passengers feel like captives in a zoo! I was informed that the sole purpose of the bars was to guard against the attacks of the pirates that infest the whole of the Chinese coast and are particularly aggressive around Canton and Shanghai.

The pirates act in a very cunning fashion. A number of them embark as steerage passengers on the steamer that they intend to attack and seize a suitable opportunity for overpowering the officers and crew. Until the continuance of these attacks compelled special precautions to be taken it was comparatively easy to do this, for there was practically always a great crowd of lower-class Chinese huddled together in the steerage quarters of coast steamers.

The next step is to compel the officers to navigate the ship to the place where the rest of the pirates are waiting, or to their headquarters in such places as Bias Bay, a notorious pirate lair between Shanghai and Hongkong. The ship is then looted completely, while any rich or prominent individual who happens to be on board is held captive until a heavy ransom is paid. At times there is bloodshed, for the pirates exhibit in its worst form the Chinese disregard for human life.



Unpleasant memories! The rails that drew attention to the possibility of meeting pirates

The seizure of ships has recently been rendered more difficult in various ways, including the erection of a strong iron railing dividing the steerage accommodation from the rest of the ship.

No doubt the strength of the pirates to-day is due largely to the unsettled conditions in China. Pirates captured by the Chinese are instantly executed, either by beheading or by the terribly cruel method of slowly slicing pieces off them with a knife. A much more effective method of dealing with these pests is to attack them in their strongholds and the British Navy has raided Bias Bay on two occasions and destroyed the homes of the pirates. More work of this kind is still necessary, however, for only just before my visit a steamer from Shanghai was seized by 40 pirates who boarded it at Amoy as steerage passengers.

We were thankful to meet with no adventures of this kind on our departure from Shanghai and presently we glided into a narrow sound between the Chinese Mainland and a large island which proved to be Hongkong. This British Colony has an area of about 30 sq. miles and it is very hilly indeed, one hill named Mount Victoria being about 8,000 ft. in height. It is usually known as "The Peak," and at its foot is the one town, Victoria, where I landed.

The residential portion of Victoria is substantially built on the sides of the hills that surround the harbour and the many terraces of brightly-coloured houses and splendid gardens present a very fine appearance from the sea. A very steep funicular railway runs to the top of the hill. The town itself is full of life. Its streets are wide and well kept and the offices and public buildings compare favourably with those to be found in the large cities of Europe.

When I arrived I could easily have imagined myself in England during a fine summer. The climate is very pleasant from November to March, but in the hot weather that extends from April to October the whole island is liable to be buried in mist. The atmosphere on these occasions is exceedingly damp. I

was told that it is then possible to wring water out of the mosquito curtains every morning, and it is necessary every evening to send the clothes worn during the day to the drying-room with which every house is provided. Another and more serious blot on the climate is the liability to typhoons, which occur periodically and cause great damage.

Rickshaws are in common use here and pass by in never-ending line. Owing to the hilly character of the town another conveyance also is largely used. This is the sedan chair, which is carried by two coolies up hills that are impracticable for rickshaws. The sedan chair is a greater burden to the coolies than the rickshaw and consequently it is put down at intervals in the street in order to give the bearers a rest. As in Shanghai, motor-cars and other modern vehicles are quite common on the streets of Victoria.

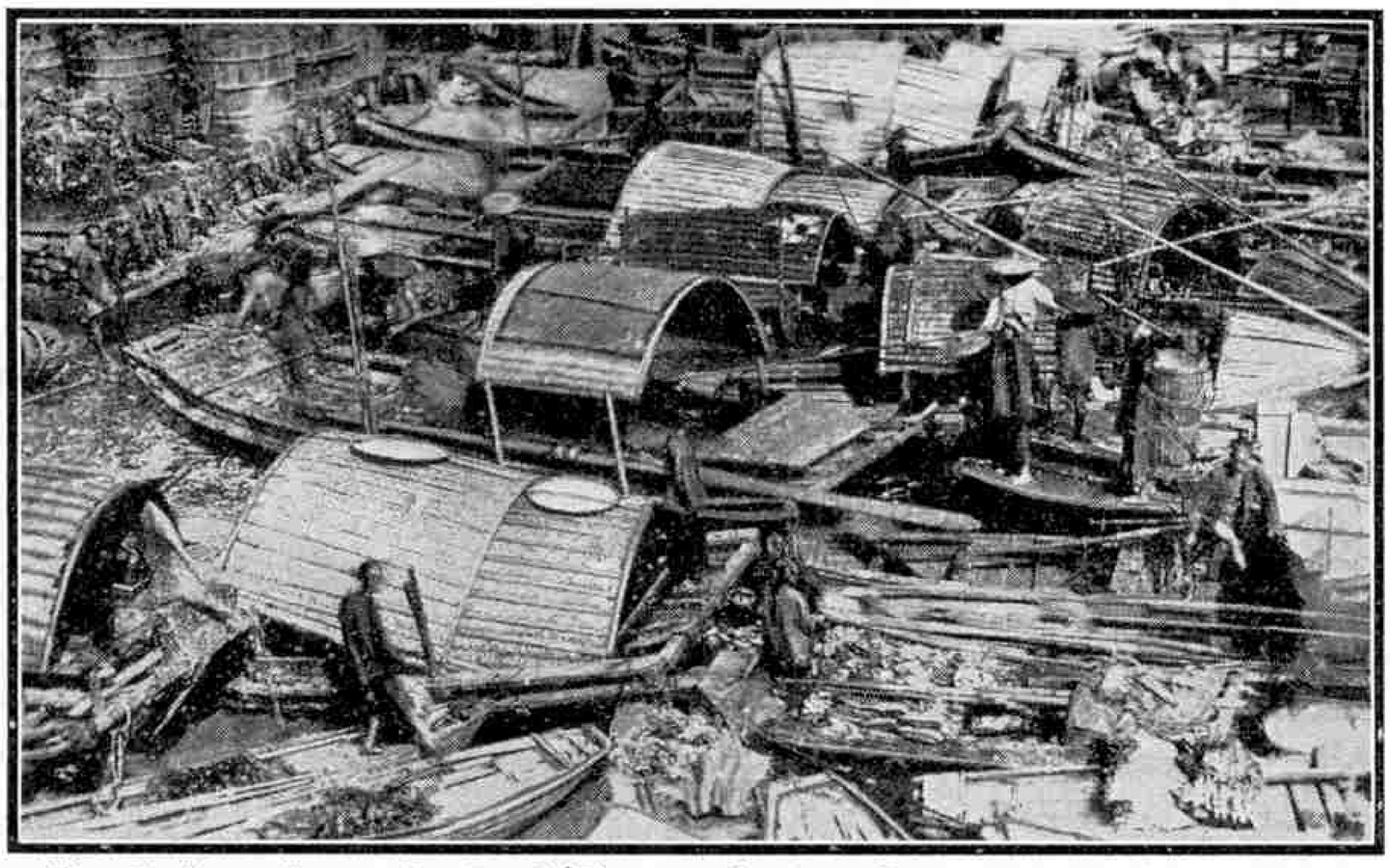
The inhabitants of Hongkong are mostly Chinese and they seem to live in the streets. A walk round the native section is full of interest. The little shops are open to the street and everywhere abound vertical wooden signs telling in golden and scarlet letters on a lacquered background the names and trades of the merchants. In the vicinity of the market place natives may be seen carrying home small pieces of fish, mysterious bits of meat, and vegetables suspended on a long piece of grass.

While staying at Hongkong I visited Macao, a small rocky peninsula about 35 miles away. This is a Portuguese settlement that was granted to them by the Chinese in 1557 as a reward for ridding the waterways of the Chinese coast of pirates. The pirates of that day had become so powerful that they terrorised the district and even threatened to blockade the Pearl River that enters the sea at this point. A reminder that the pirates were still active was given by a casual remark of the Captain of the steamer in which I journeyed to Macao. In the most off-hand manner he mentioned that he hoped to get through without any trouble this time, but in any case he had six armed men on board ready for all eventualities!

Before leaving Hongkong I paid a visit to Canton, proceeding there by steamer. This journey occupied several hours. The steamer carried the usual assembly of Chinese passengers who crowded the lower deck with their astonishing collection of luggage. We threaded our way between several islands and I was informed on approaching one of them that it was Lintin, formerly a very notorious place. It is now practically deserted, but it was the scene of much activity before Chinese ports were open for trading with foreigners. Here British and Dutch merchantmen met the Chinese junks that brought them silks, tea and other produce. Trade of this kind was illegal at that time, so that Lintin was really a smuggler's resort.

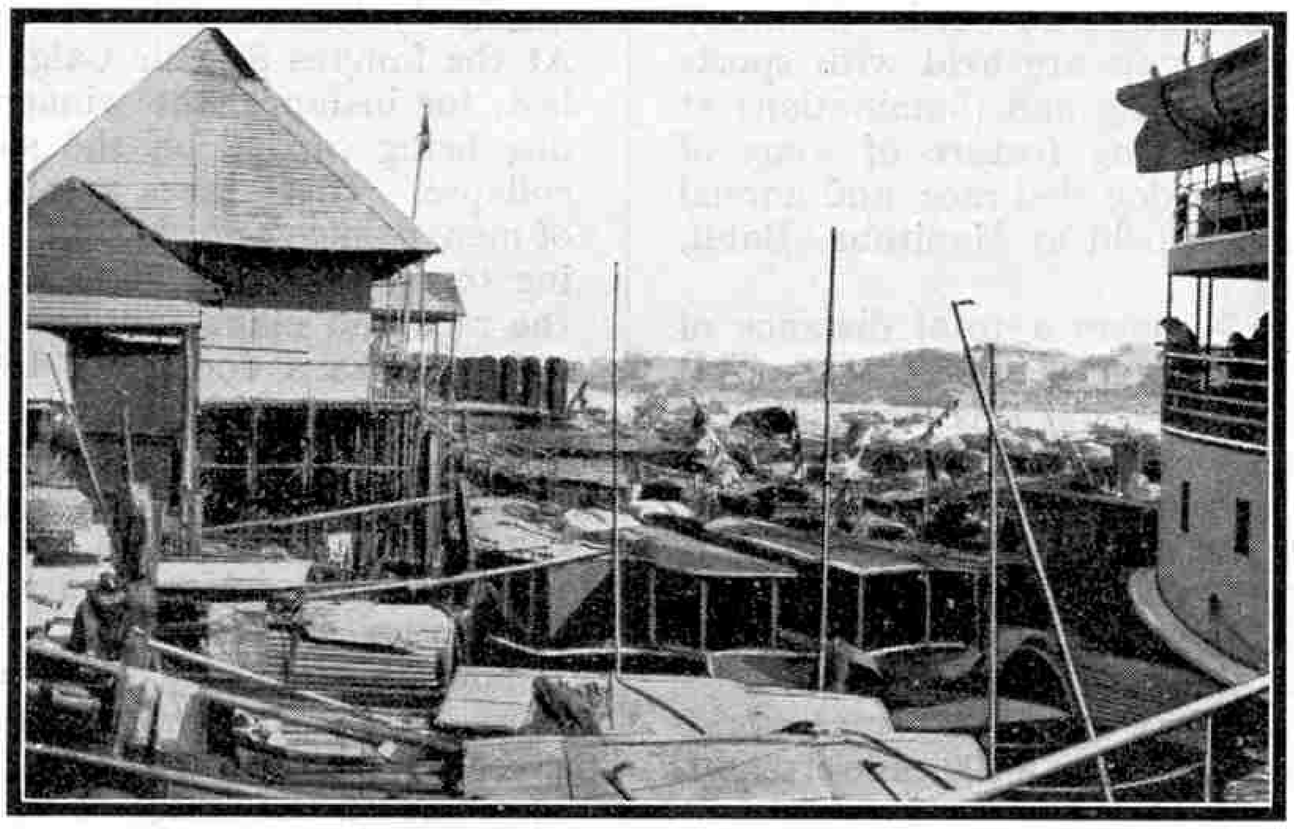
Soon after passing this island the steamer entered the Pearl River, a thick and muddy stream. The river is narrower at the mouth than further inland and the narrow strait thus formed is called the "Tiger's Mouth." This was the scene of much fighting in the wars between England and China, in 1841 and 1857. The country on each side of the river is almost flat and is mainly devoted to rice cultivation. Finally we reached Canton, about 80 miles from the sea.

The river at Canton is an amazing sight. Small boats, or sampans as they are called, crowd the water so thickly that the banks of the stream cannot be seen. The mass of sampans extends for several miles on both sides of the river, constituting a floating city in which live several hundred thousand Chinese. Many of these are born in a sampan and practically never set foot on land to the day of their deaths.



The floating city on the Pearl River at Canton. The structure of the sampan is clearly seen in this photograph

The sampan has a wide stern and the middle part is shut in by a canopy. Small as it is, it can accommodate an entire Chinese family, and very often a lodger or two, together with a variety of domestic animals. Odds and ends for which there is no room in the boat are slung from the stern, these strange collections of miscellaneous articles including nets full of vegetables, fowls in wicker baskets, flower pots and boxes of all kinds. Some of the sampans are very smart indeed. They seem to be of use principally for ferrying goods or passengers across the river, in addition to providing a home for their owners. The women usually row and steer, and most of them seem to have babies strapped on their backs. One traveller says that these women "wear" a baby in the same manner as a university graduate wears a hood, and the comparison is very apt! Their appearance is most strange when rain comes on, for then they wear a great yellow cloak of bamboo leaves and a large circular hood with a top like a steeple.



Among the sampans. The arrival of the Hongkong steamer at Canton

An amusing feature that struck me is that when children arrive at the crawling stage a short piece of bamboo is fastened across their backs. This is to safeguard them from drowning. The spaces between the knots form air chambers, thus providing sufficient buoyancy to prevent them from sinking in the not unlikely event of their falling into the water.

Towards evening the sampans settle down at the sides of the river and fires for cooking are lit on the poops. Life is not dull in this floating city, for many larger junks are moored by the banks. These are the famous "flowery boats," where gambling is carried on to the accompaniment of weird Chinese music. Altogether the floating city at Canton is one of the most amazing sights I have ever seen and I think it is safe to say there is nothing like it anywhere else in the world.

One of the two photographs on this page shows the steamer in which I travelled to Canton from Hongkong in the midst of a crowd of sampans. I was amazed at the variety of vessels to be seen in the river, and the sea-going **junks** particularly drew my attention. Their high sterns and square sails made of bamboo matting give them a picturesque appearance, but their shape makes them awkward to handle. *(To be continued)*

Thrilling Race Against Time

Dog Sled "Derbys" Across Canadian Snows

Goddard and his team winning this year's "*Pas Derby*," Manitoba

WINTER in Canada, especially in the more northerly regions, is a much more rigorous affair than the corresponding season in this country. For a long period the rivers are frozen over and the country in general lies under a thick mantle of snow. These conditions are obviously favourable to the carrying on of winter sports of all kinds and full advantage is taken of the glorious opportunities afforded. At many places elaborate winter carnivals are held with sports during the day-time and dancing and illuminations at night. A particularly interesting feature of some of these sports programmes is a dog sled race, and annual dog sled "Derbys" are now held at Manitoba, Banff, Quebec, and elsewhere.

The Manitoba "Derby" covers a total distance of 120 miles, run in three heats of 40 miles each. This year's winner of the "*Pas Derby*," as this race is called, was Emilie St. Goddard and his team, the distance being covered in the remarkable time of 11 hours 27 minutes and 15½ seconds. It is interesting to note that a younger brother of Goddard was third in the race, his time being 12 hours 4 minutes 19 seconds. It is very probable that the "*Pas Derby*" committee will revert to the old plan that made this race world-famous and that it will again become a 200-mile straight-away non-stop event.

Goddard also won this year's "Eastern International Dog Derby." This race is one of the great features of the Quebec Carnival and is a three day event over the same distance as the "*Pas Derby*," and similarly divided into three heats. This year as many as 15 teams took part in the race, the first-prize for which was $1,000 and a gold cup. Goddard accomplished the run in 11 hours 37 minutes 35 seconds, beating the previous record by 54 minutes 35 seconds. The second place was secured by Leonard Seppala, the famous Alaskan driver, who finished 20 minutes 20 seconds behind Goddard.

These races are very keenly contested and the strain on the dogs is severe, especially when the "going" is bad. The drivers of the teams look after their animals with the utmost care and it is a rule of these races that any dog that becomes incapacitated be taken immediately on the sled and carried to the finishing line. At the famous 85-mile Calgary-Banff race in February last, for instance, the winner finished with his leading dog being carried on the sled in a state of absolute collapse. These races are viewed by many thousands of men, women and children and it is extremely interesting to see how the "huskies" enter into the spirit of the race and make supreme efforts to win.

In Alaska a dog sled "Derby" was inaugurated in 1908 and has been held more or less regularly ever since. The contest is organised by Nome Kennel Club and takes place early in April according to weather conditions. The race is run from Nome to Candle, a total distance of 412 miles, and some remarkable speeds have been achieved.

The thrills of dog sled racing were easily eclipsed, however, by a dramatic race against time that took place in Alaska in 1925. In the isolated settlement of Nome on the fringe of the Arctic Circle an epidemic of diptheria broke out among the population of some 700 people. The public health officer and the only nurse available made desperate efforts to cope with the rapidly increasing number of cases, and at the same time an urgent call for help was telegraphed to the famous biological laboratory in Philadelphia, for diptheria antitoxin.

The laboratory officials promptly responded to the call and quickly a 20 lb. package containing 300,000 units of antitoxin was made up and conveyed by express

train to Nenana, the farthest point attainable by railway. There still remained 660 miles to be covered, however, and the precious package was transferred to a sled provided with a specially picked team of Husky dogs, and then began a desperate race against time across the trackless frozen wastes of northern Alaska.

Arrangements had been made for relay teams to be provided at six places en route and as each halting place was reached the package was handed over to another driver who, with his fresh team, took up the running without a second's delay. In this manner the 660 miles between Nenana and Nome, across frozen rivers and lakes and in the teeth of fearful blizzards, were covered in 127½ hours and a speed record created that made previous ones seem insignificant.

It is interesting to note that among the expert drivers specially chosen to handle the teams on this occasion was Leonard Seppala, to whom we have already referred.

In spite of the wonderful speed attained on this heroic journey the number of infected inhabitants exceeded 50 by the time Nome was reached and the package of life-saving antitoxin safely delivered. There is no doubt that but for the speedy arrival of the antitoxin the epidemic would quickly have assumed alarming proportions.

Dog sled teams played a part in the sensational rush that followed the reported discovery of a rich deposit of gold at Red Lake, Ontario, last year. The locality of the "find" was an isolated place 130 miles north-west of Hudson, a station on the Canadian Pacific Railway. Those who utilised dog teams in order to reach Red Lake had a very hazardous journey across regions practically devoid of any recognised trail. Blizzards, snow-drifts and intense cold added to the perils of the enterprise. When camp was struck for the night the dogs were generally chained to trees and they made the night hours hideous with their wailing cries. This particular gold rush is of interest also as being the first in which prospectors utilised aeroplanes.

The "Husky" and "Malamute" dogs of Alaska are particularly well suited for sled work. For journeys across the snowy interior the Husky is usually regarded as the more suitable while the Malamute, on account of its comparatively short legs, does better over the hard snows of the coast. The coats of these dogs are short but sufficiently thick and dense to provide ample protection to the animals from the intense cold.

The Malamute is a pure bred Eskimo dog whereas the Husky's origin appears to be somewhat uncertain. A notorious characteristic of the Malamute is his fighting ability, for while he makes a faithful and agreeable companion he is extremely jealous of divided affection and shows his feelings very plainly! His bushy tail, alert narrow eyes, sharp muzzle, black nose and erect ears, all help to give him a distinctive appearance. When his silver grey coat is properly tended and he is well fed and cared for he is a very handsome dog and will turn the scale at probably 80 lb. to 85 lb.

The Malamute dogs of Alaska are closely akin to the Eskimo dogs of Greenland and Iceland. In the series of articles now appearing in the "*M.M.*" relating the romance of Arctic exploration, many references have been made to the use of dog sleds by explorers. Indeed, more than one expedition over the ice wastes of the Arctic has owed its safety entirely to the splendid qualities of its dogs. In size the Eskimo dog is almost equal to a mastiff, its sharp-pointed muzzle and bushy tail affording a good indication of the animal's alertness and splendid physique.

Goddard and his lead dog photographed after the race

The notoriously savage temper of the Eskimo dog has been attributed by some authorities to its wolfish antecedents and by others to the marked indifference displayed by the Eskimos to the hunger of their dogs, resulting in the animals' barbarian tactics to obtain food. During the summer months the dogs are generally released from service and allowed to roam about and cater for themselves. At the approach of winter the animals return to their masters and during their months of service often have a lean time of it, sometimes subsisting on little more than dried fish heads carelessly thrown to them. Thus, by force of circumstance, the Eskimo dogs have developed the ability to go for remarkably long periods without food, which characteristic has been commented upon by many explorers.

Captain Lyon in his "*Private Journal of the Voyage under Captain Parry*," 1821, describing an excursion over the ice in a sled drawn by five pairs of dogs, headed by a leading dog, writes:—"The leader was instant in obeying the voice of the driver, who never hit, but repeatedly called to him by name, When the dogs slackened their pace, the sight of a seal or bird was sufficient to put them instantly to their full speed, and even though none of these might be seen on the ice the cry of 'a seal! a bear! a bird!' etc., was enough to give play to the legs and voices of the whole pack. . . . .

"The driver sits on the fore part of the vehicle, from whence he jumps when requisite to pull it clear of any impediments which may be in the way, and he also guides it by pressing either foot upon the ice. . ." Lyon goes on to remark that on their return to camp the dogs seemed "as fresh and active as when they first set out," despite the fact that in the interval they had journeyed at least 70 miles over the ice and "had eaten nothing for 48 hours."

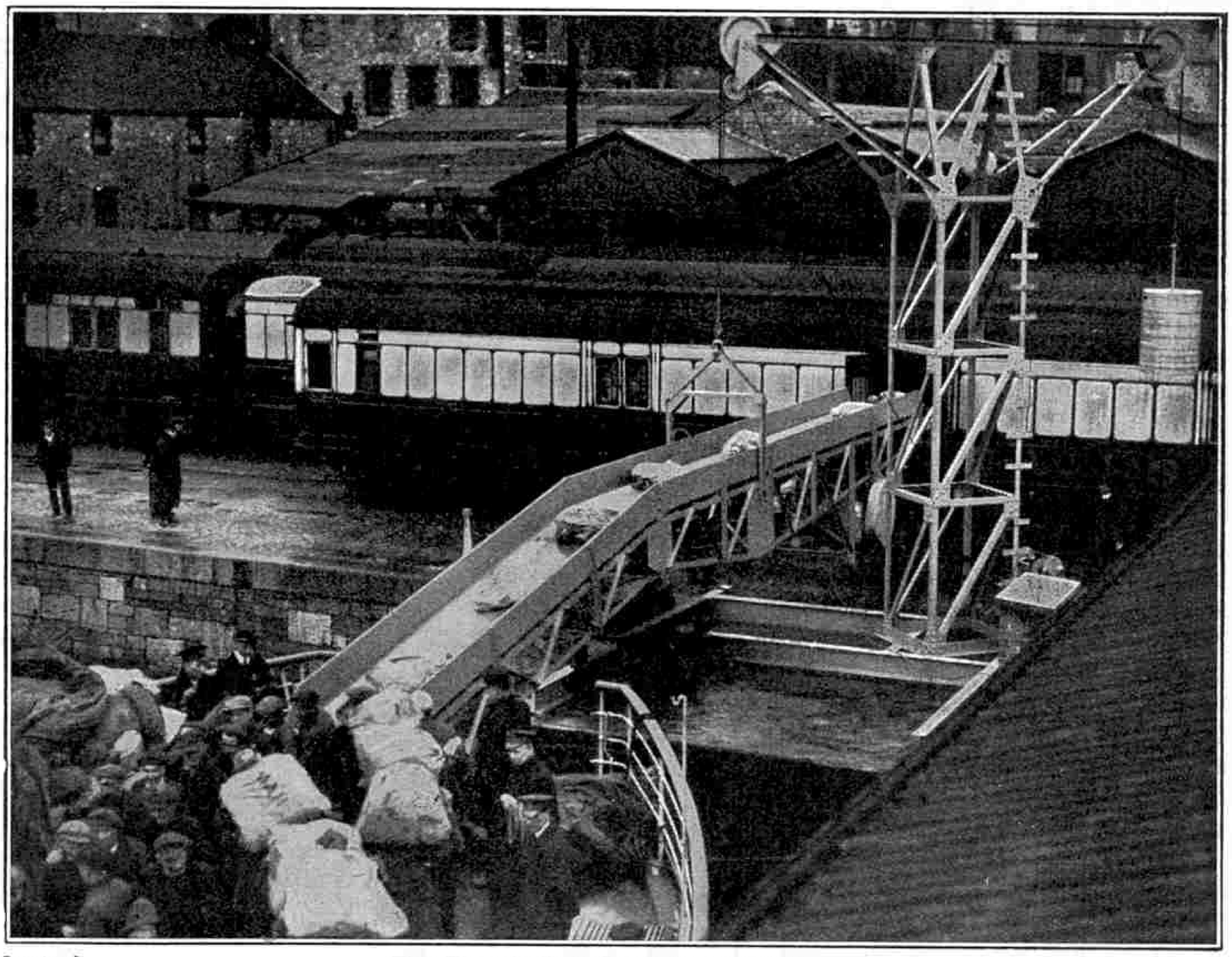
Dr. Elisha Kane, who undertook an expedition in search of Sir John Franklin during 1853, on one occasion was conveyed nearly 800 miles on a heavily burdened sledge by six dogs that had already travelled a long distance at the time his journey commenced.

Landing Ocean Mails

Conveyor from Tender to Postal Train at Plymouth

AN interesting example of the growing tendency to abolish as far as possible all unnecessary handling of goods, sacks and parcels in transit, is furnished by the successful introduction of an electric belt conveyor at Plymouth to speed up the work of transporting mail bags from ship to postal train.

The previous practice was for one or more G.W.R. tenders to meet liners in Plymouth Sound, receive the mails and return with them to the quay. Then commenced a constant procession of dock workers carrying the mail bags and parcel-post receptacles from the tenders across the quay to the train standing alongside. The number of men engaged upon this work naturally varied according to the extent of the mail, but on very few occasions could the operation be carried out with less than 100 men, while frequently from 130 to 150 men were necessary.



Courtesy] **The Electric Belt Conveyor at Work** [*G.W.R. Magazine*

This system had many obvious drawbacks, and finally it was decided to instal an electric belt conveyor to fulfil the dual purpose of facilitating the transport of the mails and of reducing the cost of the operation. The apparatus, which has been provided by Messrs. Fraser & Chalmers Engineering Works, has been installed on the quay near the Princess Royal Pier. Its principal feature is a travelling belt, one end of which is placed on the upper deck of the tender while the other delivers the mail bags direct into the railway mail vans.

On the day when the conveyor was first brought into operation, 1,221 bags of letter mail and 239 bags of parcel-post packages were dealt with upon arrival of the s.s. "*American Merchant*" from New York. The mail tender, "*Sir Walter Raleigh*," was alongside the liner at 5.10 p.m., and within five minutes the first bag was on the deck. The whole of the mail was transferred to the tender in 42 minutes, the last bag being handled at 5.57 p.m., while a few minutes later the liner had resumed her voyage to London, and the tender returned to Plymouth Docks. Upon arrival at the docks the use of the new conveyor enabled the whole of the transfer work to be effected with the utmost rapidity, although less than one-third of the normal number of men were required for the purpose. The successful introduction of the new system was watched with interest by the Plymouth Postmaster and many representatives of shipping companies and the Press.

The conveyor is of the belt type, mounted on a mild-steel braced structure, and driven by an electric motor mounted near the land end, the reduction gear operating by means of a set of spur and a chain gearing. The belt is 36 in. in width and moves at the speed of 160 ft. per minute, its capacity being 60 tons an hour. The conveyor is supported by a bridle, with its fulcrum approximately near but slightly above the centre of gravity when empty, so that when held in mid-air by the bridle the conveyor hangs near the mid-position under which it is operated. The appliance requires but a small force to place it in any working position, the necessary balance being achieved by a weight of about 5 cwt. within.

Its position is controlled by a hand-winch through the means of a wire rope attached to the supporting bridle, the winch being fitted with a pawl to take the load. When in the working position this rope is kept slack so that in the event of any surge on the tender the conveyor belt is free to rise or fall, and is thus kept in contact with the deck of the tender. On the land side it has adjustable legs so that the height of the ends discharging to the train may be controlled.

Another feature of the appliance is the balance weight supporting tower, which has been (*Continued on page* 1097)

LIVES OF FAMOUS INVENTORS

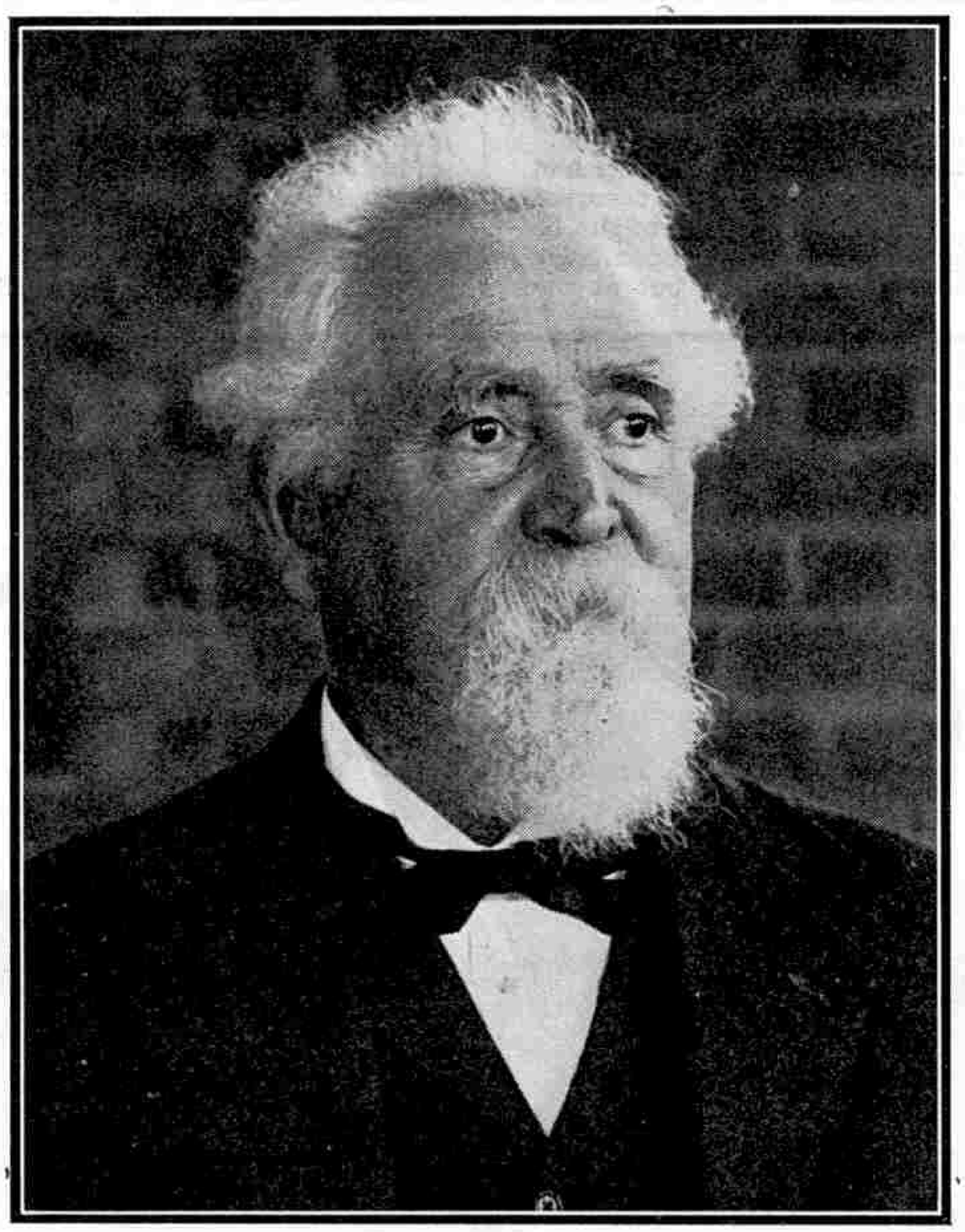
X.—SIR HIRAM MAXIM

HIRAM STEVENS MAXIM was born on 5th November, 1840, at Sangerville, Mass., U.S.A. At that time his father had a small farm, but six years later he sold this and acquired a local wood-turning establishment equipped with two lathes—a luxury in those days. Subsequently he moved to Milo, a small town a few miles away, and ultimately abandoned wood-turning and took over a well-established grist mill at Orneville, some ten miles distant. This mill was well built, had three rows of stones for grinding and was run by water power.

Hiram began his working career at the age of 14, when he was apprenticed to a carriage maker named Daniel Sweat at a neighbouring village. His father gave Sweat such a glowing account of the boy's skill with wood-working tools that the carriage maker immediately set him to work to make six strong wheelbarrows. Hiram accomplished this task so well that Sweat was amazed by the excellence of the workmanship and invited several of his friends to visit the workshop and inspect the barrows.

The job was a very trying one for so young a lad. He commenced work every morning at 5 o'clock, and his working day consisted of 16 hours, eight in the morning and eight in the afternoon! The pay was as much too little as the hours were too long and totalled only two dollars per month. Even this meagre sum was not paid in cash, but instead the boy had to draw the value of his wages from the local store. Hiram remained at this work until his father returned to Sangerville, and then he relinquished the job, wrapped his few belongings in a large red handkerchief and set off to walk the 20 miles to his native place.

During the next few years young Maxim led a varied existence, school during the winter alternating with periods of work as a carriage-maker and a wood-turner. In this manner he continued until he was about 20 years of age. Later he was employed for a while at the engineering works belonging to an uncle at Fitchburg and subsequently he went to Boston and secured employment with the Automatic Gas Machine Company at a salary of two-and-a-half dollars per day.



Sir Hiram Maxim

While engaged in these various jobs Maxim devoted all his spare time to studying electricity, with the result that he subsequently obtained a situation as engineer with a man called Schuyler who had formed the United States Electric Lighting Company, the first U.S.A. company of its kind. Maxim made rapid progress in his new job and before long was appointed chief engineer and general manager to the company at a salary of ten dollars per day. Schuyler, who was president of the company, also apportioned to Maxim 25 per cent. of the firm's profits.

Maxim realised that there were vast possibilities in the new method of illumination and was soon busy improving the company's productions. The first electric arc lamps in New York were erected by Maxim in the offices of the Equitable Insurance Company, Broadway. They attracted a great deal of attention and shortly afterwards the company were commissioned to instal their electric lamps in the General

Post Office and the Park Avenue Hotel, New York.

It is interesting to know that although Schuyler and Maxim had been making and erecting electric lamps for two years before Edison produced his incandescent electric lamp their productions were very frequently credited by the public to the more famous inventor.

At the Paris Electrical Exhibition held in 1881 the United States Electric Lighting Company displayed their electric lamps and other electrical products, under Maxim's organisation. The company's exhibits included also a machine recently invented by Maxim for maintaining constant pressure in an electric lighting system irrespective of how many lamps were in use at any one time. This machine was patented on 26th November, 1882.

While in Paris Maxim revived an idea he had entertained some ten years previously for the design of a gun operated on what he called the "automatic or re-coil principle." One day in 1873 he was thinking about a violent "kick" he had once received when firing a heavy military rifle and it occurred to him that the energy wasted in producing this kick might be made to do useful work in loading and firing the weapon. He made a few rough drawings of possible mechanisms but at the time did not complete any definite plans. The idea recurred to him in Paris and before going to London in 1883 he made careful preliminary drawings of his proposed automatic gun. In London he took a small room in Canning Street where he completed his drawings. Subsequently he acquired a workshop, equipped it with suitable tools and set about constructing an experimental gun.

The fact that he was utterly inexperienced in the art of gun-making did not deter him in the least and a number of early failures in the course of the work only served to make him more determined to succeed.

In due course he produced his first gun which, after the first cartridge had been placed in the breech by hand, loaded and fired itself automatically. This gun was only partially successful. It was operated by the backward movement of the cartridge in the barrel at the moment of firing and Maxim found that this method was not effective with the cartridges of the military type. He therefore set to work to remedy this defect and after devising and rejecting several mechanisms he produced the gun that brought him fame.

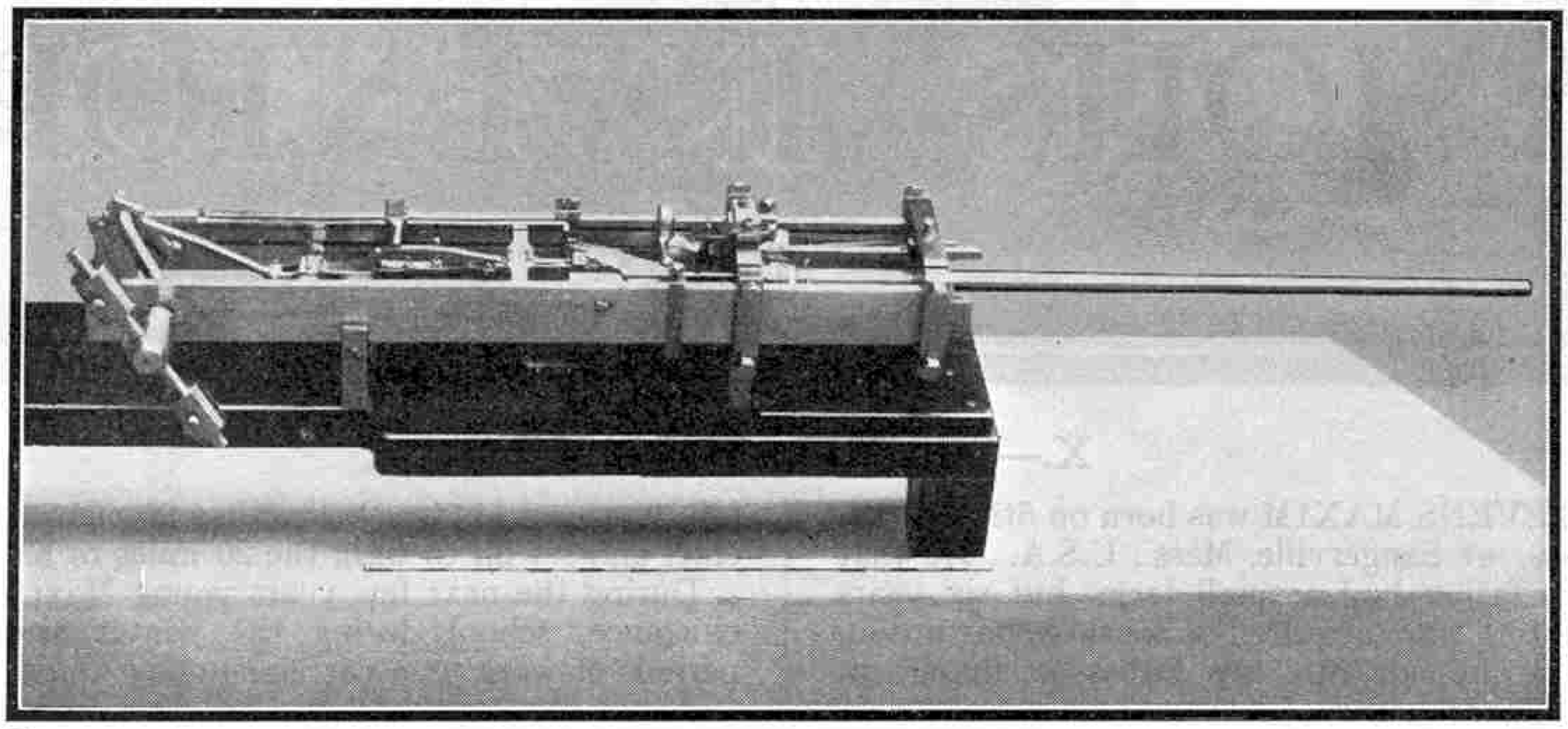


Photo courtesy] [*South Kensington Museum*

Maxim's original experimental Machine Gun

At the initial loading of this gun the first cartridge was fed to the barrel by turning a crank handle forward and downward twice. When the trigger was pulled the primer was struck and the explosion of the cartridge followed instantly. The barrel and breech block immediately recoiled, extracted the empty cartridge case and cocked the hammer. The recoil stored energy in a spring which automatically thrust another cartridge into the chamber, closed the breech, actuated the trigger and so fired the next shot. Simultaneously the next cartridge from the belt was fed into position. The cartridges were held in clips on a sort of flexible belt that was carried through the machine by the breech mechanism. The barrel was kept cool by a water jacket that surrounded it. This gun could automatically load and fire more than 12 times per second or roughly 770 shots per minute.

The above photograph illustrates the original experimental gun made by Maxim for determining the constructional details of his automatic gun. This was presented to the Science Museum, South Kensington, in 1885, by the Maxim Gun Company.

The success of the gun in operation aroused widespread interest and among the first callers at Maxim's workshop to inspect the weapon was the future King Edward VII, then Prince of Wales, who personally fired the gun and congratulated Maxim upon his invention. It is recorded that on a subsequent occasion Lord Salisbury, addressing the Prince, said: "I have just been telling Mr. Maxim that he has prevented more men from dying of old age than any other person that ever lived!"

Shortly afterward the British Government ordered an experimental gun, stipulating that it should not weigh more than 100 lb. and must be capable of firing 400 rounds in one minute, 600 in two minutes and 1,000 in four minutes. Maxim built two guns to this specification and later produced another that weighed only 40 lb. and on trial fired a thousand rounds in 1¼ minutes. The Government promptly purchased this third gun and ordered two others. At the close of a long series of experiments conducted at Hythe, Kent, the gunnery experts declared that the Maxim gun was superior in every respect to all other types of gun then in existence.

The reputation of the Maxim gun was further established as the result of an important long-range shooting contest at Thun,

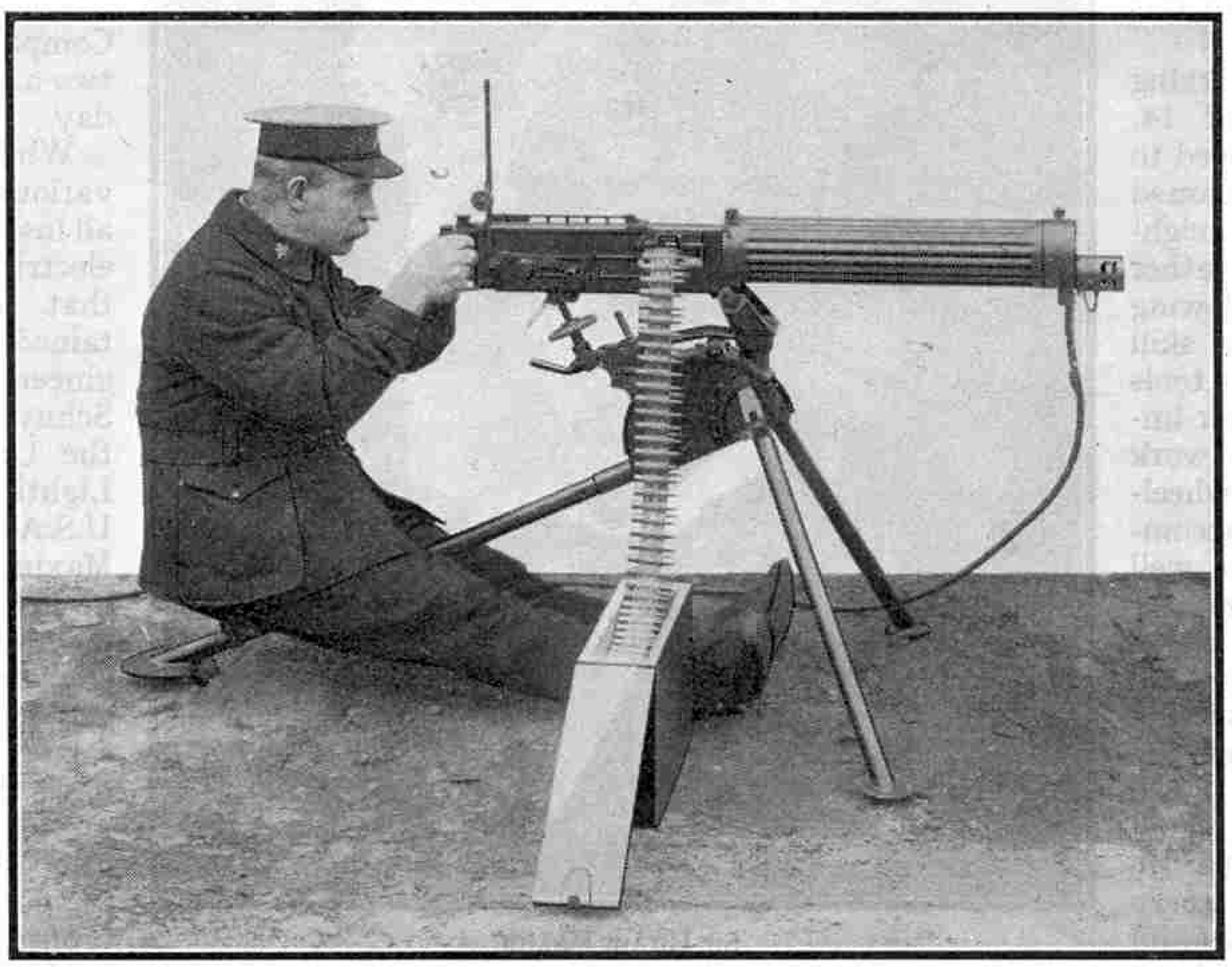


Photo courtesy] [*Vickers Ltd.*

Vickers Automatic Rifle Calibre Gun. Land Service

Switzerland. On this occasion the most formidable rival to Maxim's 50 lb. single barrel diminutive weapon was a large double barrel gun weighing about two hundredweight and capable of firing 330 rounds per minute. This gun had been victorious in every contest in which it had taken part, but its excellent record was spoilt at Thun for it jammed in action. The target consisted of a collection of dummy soldiers and an examination of these at the close of the contest showed the shots of the Maxim gun to be all grouped in the centre of the target while those of the double barrel gun were scattered far and wide. The Maxim gun, moreover, had fired at its customary rate of 700 rounds per minute.

Maxim next took his gun to Italy where also it outclassed all competitors and resulted in an order to supply 30 guns for the Italian Navy. In Austria the gun was exhibited at Vienna where it was inspected and personally fired by the Archduke William, who declared that it was the most deadly instrument of war he had ever seen. The gun was also demonstrated to the Shah of Persia during a visit to London, and on this occasion Maxim had many anxious moments in preventing the Shah from shooting his Grand Vizier, who would persist in leaning over the muzzle of the gun while the Shah was fingering the breech mechanism!

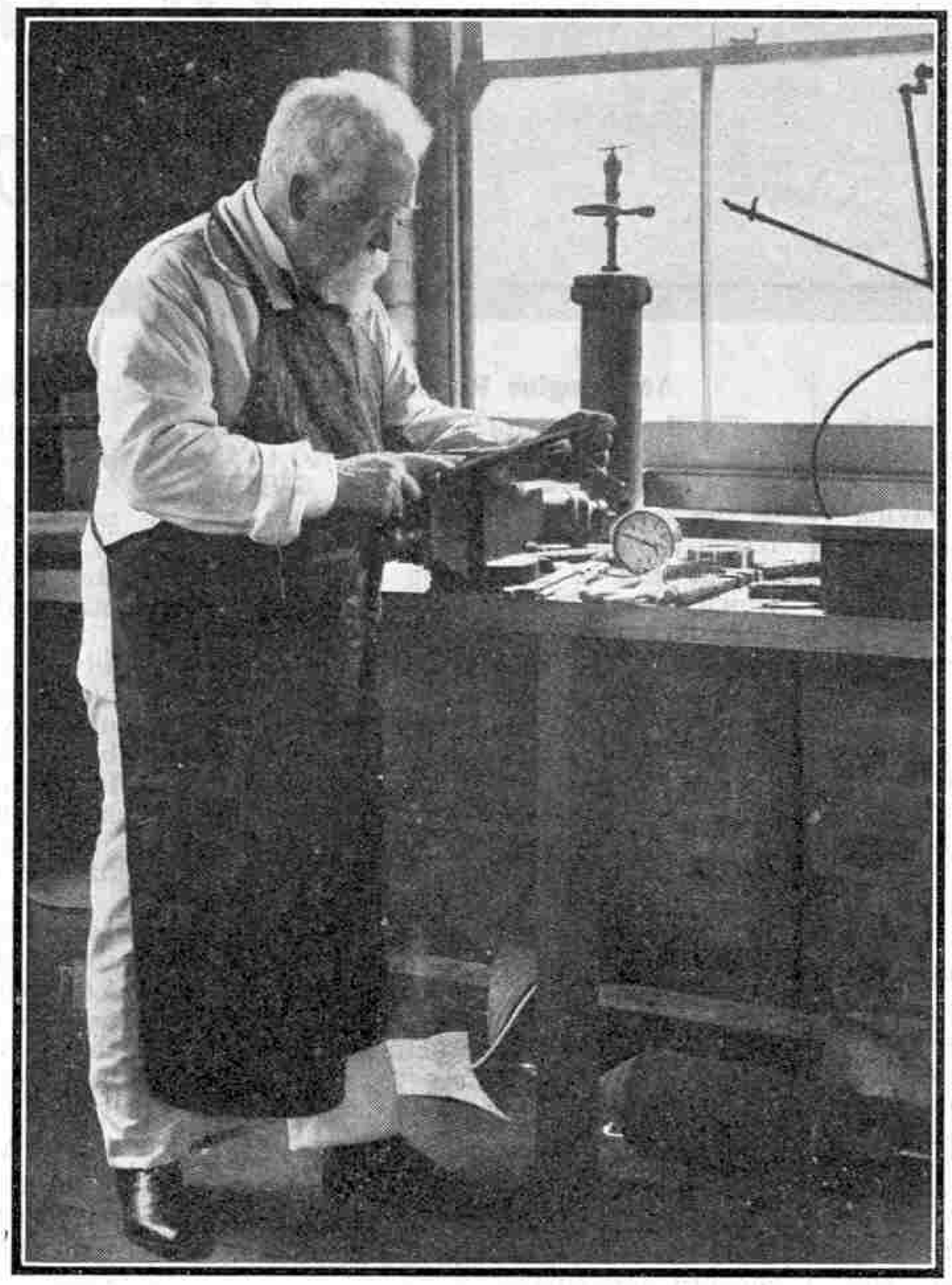
In 1883 Maxim became acquainted with Randolph R. Symons then vice-president of the Mexican Central Railway, and Albert Vickers. The three men decided to join forces and during the following year organised the Maxim Gun Company. Four years later this company amalgamated with the Nordenfelt Gun Company, which hitherto had manufactured only hand-fired guns. The new firm was given the name "Vickers, Son and Maxim," and at the Erith Works of the Nordenfelt Company Maxim guns were soon being manufactured in a great range of sizes.

The success of Maxim's light gun was now assured and the inventor turned his attention to perfecting a quick-firing gun of heavier calibre. He succeeded in producing a gun that fired more than 40 rounds per minute as compared with the 25 rounds per minute of the most efficient heavy gun then in use. In addition, Maxim's gun required only one man to manipulate it whereas other guns required four men.

Another of Maxim's inventions about this time was a gun for firing a torpedo through the air when sea conditions were bad. This invention resulted from the belief that the ordinary type of torpedo would not maintain an accurate course in a rough sea. He also invented a method of manufacturing a gun of average size from one solid piece of metal instead of building it up of numerous metallic coils and rings as was the usual practice. This method of manufacture resulted in a great saving of money and material, and guns made by means of it withstood, under test, a pressure of 22½ tons per square inch.

A great deal of important and little-known work was carried out by Maxim in connection with explosives. It is probable that he was led to experiment in this direction as the result of annoyance he had experienced with unreliable and sometimes dangerous explosives. Among many other successes he succeeded in solving the mystery of a foreign explosive that had puzzled the British experts. This had remarkably slow-burning properties and yet on analysis it was found to contain merely the usual ingredients. Maxim obtained some of the explosive and retired with it to his laboratory for a minute examination. Ultimately he discovered that the grains of nitre in the foreign explosive were considerably larger than those used in the English explosive, and therein lay the secret. Maxim then set to work to improve upon the foreign preparation and before long succeeded in producing a smokeless explosive of very considerably higher efficiency.

But for an unfortunate occurrence it is extremely probable that Maxim would be regarded as the inventor of the explosive known as cordite. He took out his patent for the explosive 14 days before a similar patent was granted to Professor Dewar and Sir Frederick Abel, but owing to a flaw in one sentence of his specification he lost his claim to be the original inventor. For many years Maxim had been interested in the problems of aviation and after he had practically retired from active business and settled at Baldwyn's Park, he devoted himself seriously to the construction of a flying machine. The work was commenced in 1893 and the machine was duly completed in the following year.



Sir Hiram Maxim in his workshop

Maxim's flying machine presented a very striking appearance, bearing considerable resemblance to a kite of gigantic size. The huge central plane had a surface area of 1,400 sq. ft. and a spread of 126 ft., and in addition, there were one fore and one aft steering, or elevating planes, and at each end of the central wing two extensive side planes inclined upward at an angle of 72 degrees, strongly suggestive of half-raised arms.

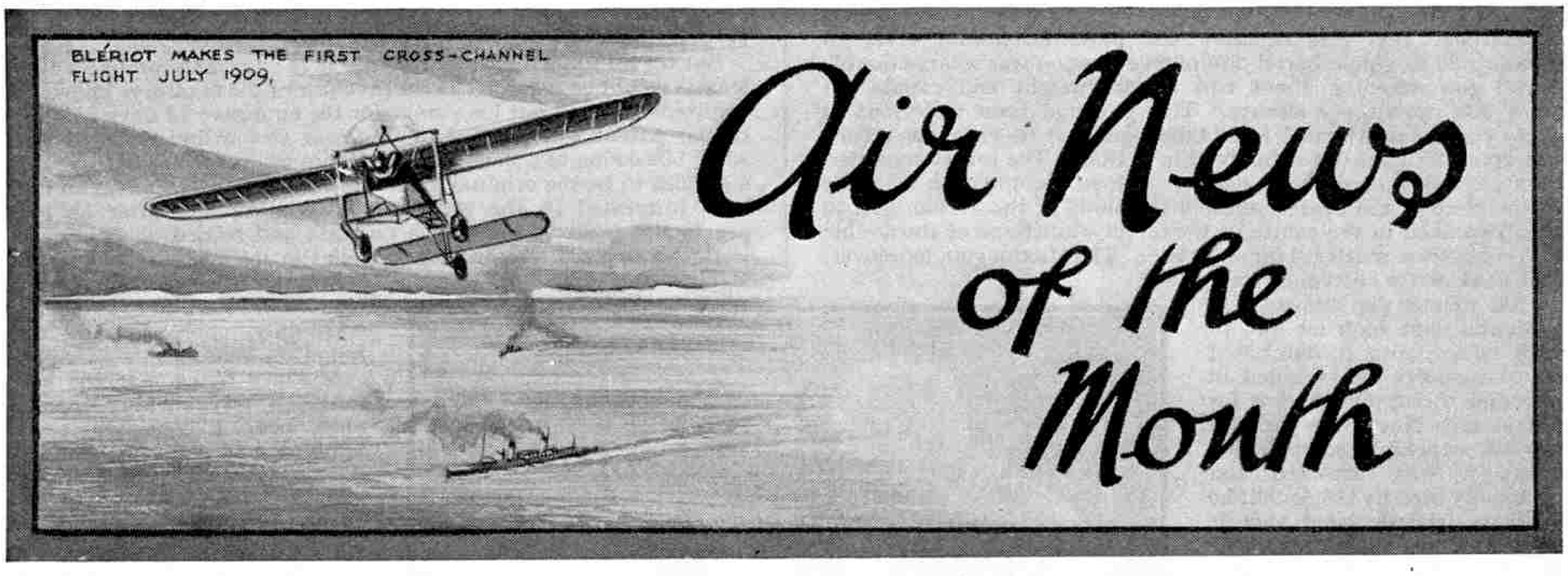
The machinery was carried on a platform suspended in a central position from the principal plane. The 350 h.p. compound steam engine weighed about 600 lb., and by its situation on the platform was roughly 8 ft. above ground. The boiler comprised a multitude of small copper tubes having a total heating surface of 800 sq. ft. and a capacity of approximately 40 lb. of water. It was heated by a naphtha burner having a flame surface of 30 ft. A naphtha-heated vaporiser created the naphtha gas, which was passed at a pressure of 50 lb. per sq. in. to the burner jets, numbering more than 7,500. At the burner the pressure was brought down to 1 lb. per sq. in. One effect of this drastic reduction was to draw in air to assist combustion. The plant's capacity consisted of 600 lb. of water and 200 lb. of naphtha, while the total weight of engine, boiler and water, and generator was 1,090 lb.

The machine possessed two formidable-looking propellers, the blades of which were 5 ft. 2 in. in width and of 16 ft. pitch. Each propeller had a diameter of 17 ft. 10 in. and weighed 135 lb. They were capable of 375 revs. per min. and developed a speed of 40 m.p.h. When started up the propellers were allowed to develop a thrust of some 1,500 lb. before the machine was released. It then travelled along a prepared steel track at a speed of about 35 m.p.h. After a short distance the track was elevated and the machine was raised up it by the combined action of the propellers and wings.

On 31st July, 1894, the flying machine was started up for a trip with three people on board, and on being released sped forward somewhat faster than usual. It lifted so energetically that a portion of the upper track that limited the ascent of the machine was wrenched away and, canting upward, fouled one of the screws as the machine swung freely in the air. The screw was smashed and the machine descended to earth and was partially wrecked.

This was the first time in history that a flying machine, carrying passengers, engine, boiler, water and fuel, had arisen entirely unfettered into the air. Maxim's subsequent investigations of the problem of flying were mostly of a theoretical nature, but his experiment of 1894 had proved that it was possible for a machine carrying engines, fuel and crew to ascend from the ground.

In 1901 Maxim was knighted by Queen Victoria in recognition of his inventions and scientific research. His interest in engineering and aeronautical matters continued unabated throughout his life and he died at Streatham on 24th November, 1916, at the age of 77.



Air News of the Month

A Record Non-Stop Flight

Mr. "Bert" Hinckler, the Avro Company's famous test pilot, recently made a splendid non-stop flight, London to Riga (Latvia) in his "Avian" light aeroplane. Leaving Croydon at approximately 5.30 a.m. he arrived at Riga shortly before 4.15 p.m., his time for the 1,200 miles trip being barely 10¾ hours. This shows an average speed of well over 100 m.p.h., a splendid performance for the 30-80 h.p. "Cirrus" engine with which the machine is equipped.

The cost of this long flight was approximately £2, the machine averaging 30 miles to the gallon of petrol over the complete flight which, by the way, is by far the longest non-stop run ever accomplished by a light aeroplane.

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"Moths" to be Built in Germany

A license has been granted to a German firm by the de Havilland Company for the construction of the famous "Moth" machine. This is the first occasion since the war that a license for the construction of British aircraft in Germany has been granted, and it is anticipated that quite a considerable number of "Moths" will be turned out, for private flying is making great strides in Germany to-day. The "Cirrus" engines with which the machines are to be equipped will still be built in England.

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Success of Cairo-Basra Route

The Middle East air route has now been in operation for several months and already the service has proved a great success. The operating figures for the first five months show that every scheduled flight has been carried out without interruption. There has been a steady growth in the volume of mail matter carried, from 21,400 letters in January to 78,100 in May. The mileage flown during the five months was as follows:—January, 8,866; February, 6,541; March, 5,290; April, 9,636; May, 9,361. The monthly variation is due to special work additional to the regular service, which was fortnightly between Cairo and Basra up to 6th April and weekly from 13th April.

There is little doubt that the traffic will expand enormously, particularly when the originally projected through service to India comes into operation. The delay is due to the failure of the Persian Government to grant the promised facilities for the safe passage of aircraft across its territory.

Aero-Engine Running Costs

The three "Bristol" Jupiter VI engines, Nos. J.6071, 6072, and 6074, fitted to the Handley-Page "Hampstead" G-EBLE in the service of Imperial Airways, were recently subjected to a "top overhaul" at the end of 250 flying hours, during which they had functioned perfectly. The following parts were found to be worn and to require replacement:—Four piston rings (cost 2/3 each); two scraper rings (3/9½ each); one outer valve spring (1/3½); and 14 inner valve springs (1/1½ each); total £1/13/7½. In addition to these partially worn parts there are such items as washers, gudgeon-pin clips, packings, split-pins and the like, which are invariably renewed when re-assembling an engine after overhaul. The cost of these routine replacements for the three engines came to £12/7/4½ or nearly eight times that of the worn working parts! The total cost of approximately £14 for spares for three engines that had each flown approximately 25,000 miles works out to .134 pence per mile, or at the rate of about 7½ miles per penny!

This can only be regarded as an amazingly good figure, and it shows how little wear and tear takes place in a well-designed modern aero-engine.

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South African Air Mail

The South African Government announce that a five-year contract for a new commercial air service has been placed with the Alan Cobham Civil Aviation Company, and that for the first two years a subsidy of £8,000 per annum is to be paid to the company. Operations probably will commence early next year and flights will be made three times a week each way between Johannesburg and Durban. After this service is established a daily service between Durban and Maritzburg will be opened. The times for the respective trips will be 4½ hours and 30 minutes, the fare for the Johannesburg-Durban run being £8/10/– for the single trip. The company also proposes to introduce aerial taxis, "joy rides" and week-end trips to Port St. John's, while at a later stage a service to East London will be established.

The machines employed will be of the D.H.50 type, fitted with 350 h.p. "Nimbus" engines, each machine providing accommodation for four passengers. Mails and light freight also will be carried. The pilots all are to be special reservists of the South African Air Force.

Empire Airship Mooring Masts

Montreal has been selected as the location of the Canadian mooring mast for the proposed Empire air service, and negotiations are now in progress for a site of nearly 600 acres of land, the estimated cost of which will be £35,000. The mooring mast will entail a further expenditure of £75,000. The site has been chosen on the advice of Major G. H. Scott, the commander of R.34 on its trans-Atlantic flight, as the most favourable on the score of its accessibility, population, and rail transportation facilities. As soon as the purchase has been completed work will be commenced, and it is anticipated that the mast will be finished in the summer of 1928.

The total cost of the mooring mast is being borne by the Dominion Government, the British Government providing the 5,000,000 cubic ft. capacity airships to be used on the route. It is anticipated that this service will bring Canada within 60 hours of Britain.

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A New U.S. Aircraft Carrier

Rapid progress is being made in the construction of the new aircraft carrier, "*Lexington*," which is being built on the Fore River, U.S.A. for the United States Navy.

The ship is 874 ft. in length and has a beam of 105 ft. while its displacement is 33,000 tons. It will be propelled by quadruple screws driven by specially designed turbo-electric machinery, comprising four 35,200 k.w. turbo-generators supplied with steam from 16 oil-fired boilers.

Accommodation is provided for over 100 aeroplanes, which will be stored below decks and conveyed from their compartments by electric lifts to the flying deck, which will be 900 ft. in length. In addition to twelve 5 in. anti-aircraft guns, the "*Lexington's*" armament includes eight 8 in. guns, arranged in four twin turrets, and 12 torpedo tubes. The estimated total cost of the vessel is £9,000,000, and it will be ready for trials early next year.

* * * *

Britain's Youngest Airman

Since publishing our recent article on Robin Sanders Clark's aerial adventures, news comes to hand that Robin no longer can claim the distinction of being Britain's youngest airman. It passes to Lawrence Middleton of the Newcastle-on-Tyne Aero Club who recently did his first solo flight. He is only 14 years of age.

Bullion by Air

Although comparatively few people are aware of the fact, one of the most regular types of cargo carried by Imperial Airways is bullion and specie. Those authorities responsible for the transfer of gold between Paris and other Continental cities and London have found that aerial transport is not only the speediest but also the least risky means of transfer. The almost entire elimination of pilfering by the reduction in the number of times that the specie boxes are handled has actually resulted in the insurance rates for air-borne consignments being considerably lower than for those conveyed by any other form of transport!

An excellent example of how transport costs are reduced by those countries with aerial facilities is furnished by the statement that the cost of transferring bullion between the Union of South Africa and Rhodesia last year was £357,000, whereas by air the cost would have been £100,000. It would seem that there is big scope for the new service about to be instituted in South Africa by the Alan Cobham Aerial Service Company.

* * * *

French Mails to South America

The French Government have granted a subsidy of £50,000 in the current financial year to the Latecoere Air Lines of France in consideration of the establishment of a regular air mail between West Africa and the South American continent. The subsidy for a full year will be £314,000. The service is being operated once a week in each direction from St. Louis, Senegal and Pernambuco via Cape Verde Islands and Fernando de Noronha. Ultimately it is to be linked up with the existing services of the company at Marseilles at the European end and with Rio de Janeiro, Monte Video and Buenos Aires in South America. All machines used on the route must either be fitted with wireless instruments or must carry homing pigeons. Seaplanes or flying boats are used over water and aeroplanes over land. At present only mails are to be carried but it is anticipated that authority to carry passengers will be given later. The time of transmission of letters between France and South America will be reduced from 25 to 8 days.

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The Mexican Government are making a strong effort to bring their air force up to a completely modern condition. Specially selected airmen have been sent to Europe to study the latest developments in aviation and have been authorised to spend approximately £50,000 on the purchase of machines.

Newfoundland to Japan in 16 Days

The last successful trans-Atlantic flight of this year was accomplished by two Americans, Messrs. Brock and Schlee, who flew from Harbour Grace, Newfoundland, to Croydon, towards the end of August, on a Stinson monoplane equipped with a Wright "Whirlwind" engine. The two airmen had been waiting for nearly a year to make this flight, which was the first stage of an attempt to circle the globe in 28 days.

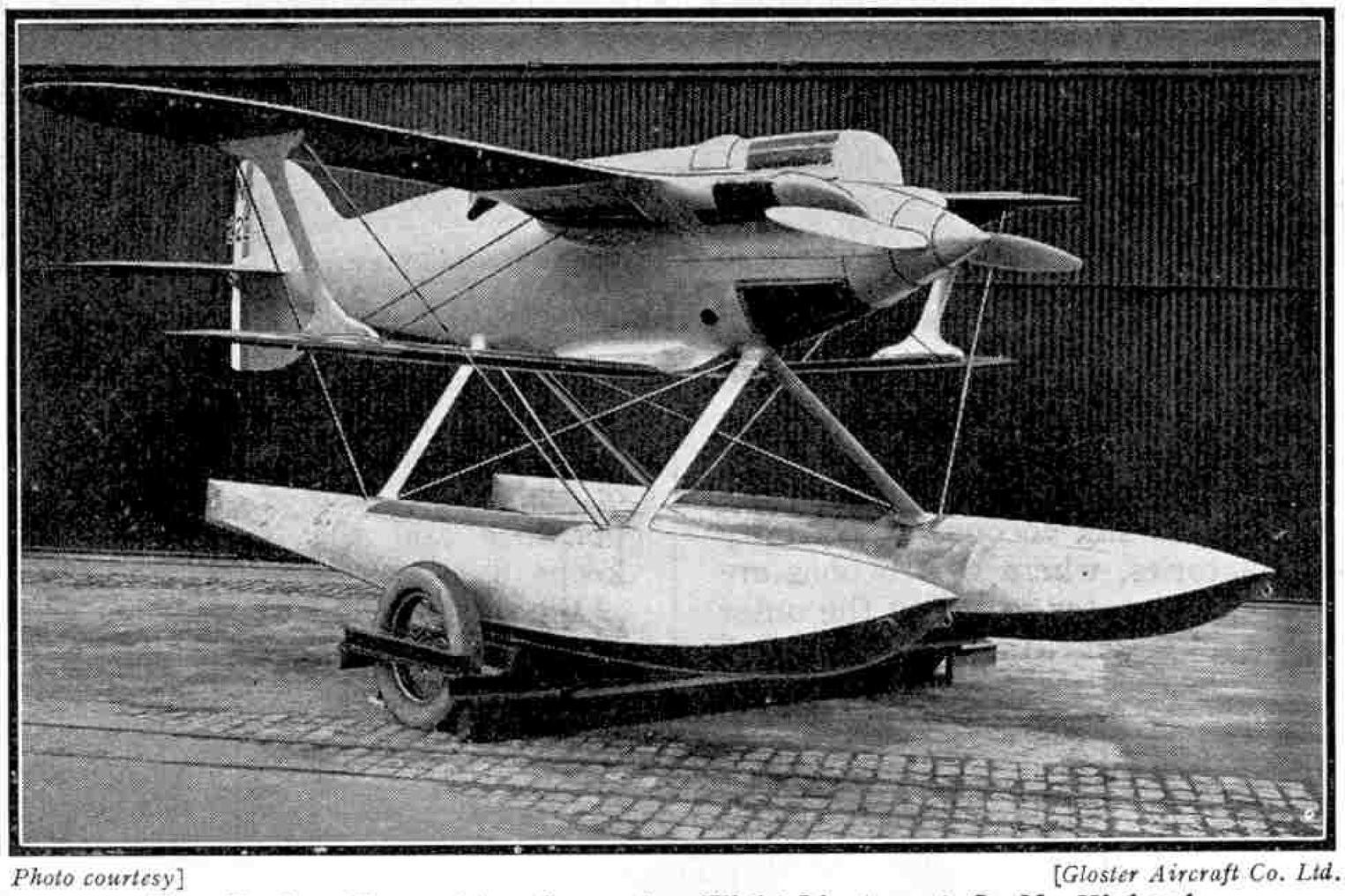

Photo courtesy [*Gloster Aircraft Co. Ltd.*

The Gloster IV machine flown by Flight-Lieutenant S. M. Kinkead in the race for the Schneider Trophy

Little publicity attended the commencement of the trip. The arrangements had been well thought out and fuel supplies were available all along the route from Harbour Grace to Tokyo, which was reached on 14th September by way of Croydon, Munich, Belgrade, Constantinople, Aleppo, Baghdad, Bunder Abbas, Karachi, Allahabad, Calcutta, Rangoon and Manila. It was intended to fly from Tokyo to Sand Island in the middle of the Pacific in one "hop" of 2,480 miles, and thence to Honolulu and San Francisco, the continuous flights to the last two points being 1,440 and 2,400 miles respectively. The last stage of the flight was to have been to Harbour Grace via Cheyenne, Chicago and Detroit, to complete the total distance of 22,067 miles. Unfortunately the trip had to be abandoned at Tokyo owing to the extremely unfavourable conditions prevailing in the Pacific. It would have been little short of suicide to attempt to continue and the American airmen very wisely decided to rest content with the laurels achieved in flying eastward from Newfoundland to Japan in 16 days.

* * * *

Lindbergh's Invitation to the Moon!

It is stated that the mail delivered to Colonel Lindbergh, the American aviator, after his great flight from America to Paris, was the largest one ever received by a private person in the whole history of the Postal Union. The mails included over 1,000 telegrams, 7,000 offers of marriage, 14,000 packets of presents, 5,000 effusions in verse and three invitations to go to the moon in a rocket!

American Millionaire's Flying Holiday

The European holiday recently completed by Mr. Van Lear Black, an American newspaper millionaire, probably will stand for many years as the most concentrated bit of travelling ever accomplished by a holiday-making American. Mr. Black reached Europe in March last and, "just to fill in time," decided to see the world by air. Since then he has flown over 27 countries and set up a new record for the longest passenger flight. His complete experience has been such that before sailing for America he declared he would never sail or go by rail again if the proposed journey were at all practicable by air.

The machine used was a K.L.M. Fokker air liner with Bristol-Jupiter engines. Several long flights covering the greater part of Europe and including several non-stop flights of over 1,000 miles had been made when, at the end of May, urgent business calls made it necessary for Mr. Black to travel to Batavia. Arrangements promptly were put in hand and a start was made on 15th June. The flight was carried through almost to schedule, and Batavia was reached in 86½ hours flying time, spread over 16 days. After a week spent in Java the homeward flight was commenced, following the line of the outward flight, Amsterdam, Budapest, Constantinople, Baghdad, Basra, Bunder Abbas, Karachi, Calcutta, Rangoon, Bangkok, Singora, Batavia. The machine landed at Amsterdam on 22nd July, the total homeward journey having occupied 97 hours flying time spread over 14 days. The longest day's run was from Constantinople to Nuremburg, in Germany, about 1,400 miles, covered in two stages totalling 13½ hours. The total distance flown was 18,700 miles at an average speed of 102 m.p.h.

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A curious monoplane that appears to fly tail first has recently been built by the German Focke-Wulfe Company. The elevator and stabilising planes are built on an extension of the fuselage in front instead of at the rear.

* * * *

Imperial Airway's New Enterprise

Toward the end of next month, Imperial Airways Ltd. will inaugurate the first European air travel route. This tour is mapped out to occupy 35 days, during which places such as France, Spain, Morocco, Algiers, Tunis and Sicily will be visited. The total length of the tour will be approximately 5,500 miles and the total cost, inclusive of hotel accommodation, will range from £350 to £400 per passenger.

Here is an excellent opportunity for some reader! Why not establish a booking agency for aerial tourists?

THE STORY OF SILK

III.—FROM COCOON TO FABRIC

LAST month we described the life of a silkworm and how the cocoon is "stifled" to suffocate the chrysalis within before it can mature into a moth and ruin the cocoon by breaking through it to freedom.

The reeling or unwinding of silk cocoons is generally carried out at the silk factories, where the cocoons are first placed in a tank of warm water to soften the outer cover of "floss," or waste silk, by melting the "varnish" binding the thread together. When the outer cover is loosened it is easily brushed off and one end of the raw silk thread composing the true cocoon is then located without difficulty. This thread is of such fineness that 13,000 yards weigh only 1/17th of an ounce.

When freed of the covering of coarse silk, each cocoon is placed in a second tank of warm water, immediately beneath a reeling machine. A single thread is much too fine to be of practical use, and therefore the threads of not less than six cocoons are drawn up to the reeling machine where each thread is passed through its individual hole or "glass eye" in the machine frame. The six threads are then twisted together to form one compound thread and this is guided to one portion of the winding drum or reeling wheel.

A further six threads are now drawn up from the tank and are similarly passed through holes in the frame and twisted into one compound thread. This thread is then twisted several times round the other before being led to and wound around the other half of the winding drum. The central twist effected where the two compound threads momentarily intertwine is called the "*crossieur*," and is very important in that it not only presses the various delicate threads more closely together but cleans them of many impurities, and also dries them.

When a cocoon is almost completely reeled the thread of a new cocoon is immediately taken up to succeed it and at the right moment is incorporated in the respective compound thread. In this manner the correct number of individual threads making up either of the compound threads is maintained and uniform thickness of the latter assured. These points are of great importance and the operator in charge of the reeling keeps a constant watch for signs of failing threads.

When the drum of a reeling machine is fully loaded the machine is stopped while the two masses of wound silken thread are removed. These masses of thread are known as "skeins" and are passed to the "throwing mill," there to be subjected to many successive processes before the silken thread is finally ready for weaving into fabric. These various treatments are simple but of great importance.

Joseph Marie Jacquard

The skeins, after removal from the reeling machine, are first carefully sorted out into different grades according to fineness of thread and freedom from knots and other inequalities. They are then immersed for several hours in warm, soapy water to cleanse them and are then hung up to dry.

The washed and dried raw silk is transferred to a winding machine, which is a long frame comprising from 20 to 30 wooden skeleton drums, rather like small paddle wheels, alongside each other. Various sizes of skeins can be accommodated on these drums, or "swifts" as they are called, a skein being kept in position by means of six pairs of slender elastic rods that take the place of the blades on a paddle wheel. Above each swift is a bobbin having a small cylinder of lead projecting horizontally from one end. When the bobbin is in position on the frame the lead cylinder is in contact with the leather-covered flat edge of a small wooden wheel beneath it, and which is mechanically revolved. As this wheel rotates it causes the lead cylinder, and consequently the bobbin, to revolve in the opposite direction. This movement is known as "friction motion."

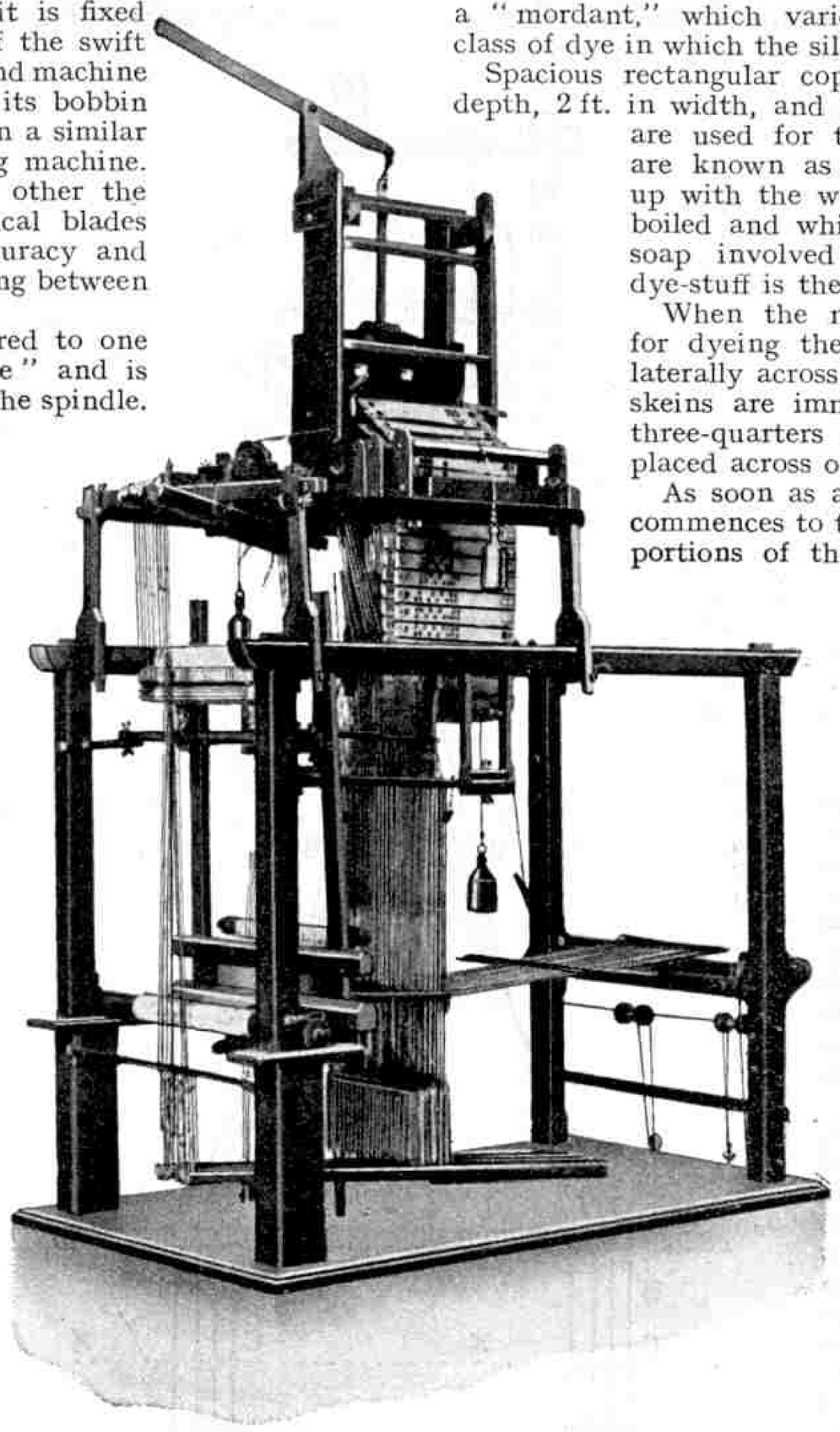
When a skein of silk has been adjusted on the swift

the thread is drawn up and, passing through a looped guide wire fixed on the top of the frame and immediately in front of the bobbin, is secured to the latter. As the bobbin rotates it winds the thread upon itself, and a reciprocative lateral motion imparted to the bobbin by mechanical means ensures the thread being wound around as evenly as possible. Each bobbin accommodates over 100 yards of continuous thread and one operator can superintend as many as 30 swifts simultaneously. Stoppages caused by the thread breaking in the course of winding are very infrequent.

The loaded bobbin is now taken to the cleaning room where, on a similar machine, it is fixed in a position corresponding to that of the swift in the previous operation. On this second machine the raw silk thread is unwound from its bobbin on to another bobbin that is rotated in a similar manner to the bobbin on the winding machine. In passing from the one reel to the other the thread is guided between the vertical blades of a double knife set with great accuracy and sharpened so as to free the thread passing between them from all hairs and unevenness.

The bobbin of silk is then transferred to one of the spindles of a "throwing frame" and is fitted on to an arm that revolves with the spindle. A small cylinder around which is twisted a curved wire having a small loop at each end is then loosely fitted on the spindle arm. The thread is led off from the bobbin and up through the wire eyelet holes to a horizontal bobbin above. In operation, the spindle revolves at such a speed as to cause the thread to unwind off the loaded bobbin faster than it is absorbed by the new bobbin, and in passing from one to the other the thread is twisted many times, sometimes receiving as many as 60 twists per inch.

The effect of this is to greatly strengthen the thread, but it is not sufficient to render it strong enough for the majority of weaving work. The thread, now wound around its third successive bobbin, is therefore "thrown" again, this time with the aid of a mechanically operated frame called a "doubler," which folds and twists a number of such compound threads together, resulting in a final composite thread of increased size and strength. A safety device stops the bobbin in the event of the thread breaking or a shortage of material occurring. As many as 50 original threads may be embodied in the composite thread obtained by this second throwing, but even so it is finer than human hair and is perfectly clean and free from knots or other imperfections.



An early form of Jacquard Loom.
The perforated cards are clearly shown in the photograph

The thread is not yet ready for the weaver, however, and it is now rewound from the small bobbin on to a large skeleton drum. This drum is then placed in a steam chest for a time and on removal the skein of silk is dried preparatory to sizing. This process consists of classifying the silk for size and quality, the former being done according to weight, a certain length of each skein being weighed. After classification the thread is rewound into skeins, usually of 10,000 yards of continuous thread, and is then ready for the attention of the dyer and the weaver.

The hardness of the thread composing the skeins is due to the fact that it still contains much of its original silk gum and while in this state the thread is referred to as "hard silk." The thread used for the best weaving and embroidery has this gum boiled out of it and is also dyed before being woven, but for inexpensive dress fabrics, fine gauzes, cheap silk umbrella covers, etc., the thread is woven in its hard state and the material boiled and dyed in the piece afterwards. The silk thread woven into airship and balloon envelopes is boiled prior to weaving but is not dyed, and after weaving is proofed to render it airtight and impervious to wet.

When the silk is required to be freed from gum before being woven, the skeins are loosened carefully and tied in bundles of convenient size. These are then inserted in soft muslin bags and placed in a copper boiler filled with water in which some dyer's soap has been dissolved. The water is heated sufficiently to boil gently for a couple of hours, after which the bags are taken out and the skeins removed. These are then thoroughly rinsed in cold water in order to bring away all gum and soap, leaving the silk lustrous, soft and white. A skein loses about a quarter of its weight during boiling and rinsing by reason of the residue removed from it.

To ensure the skeins dyeing evenly and thoroughly they are first immersed for several hours in a chemical solution called a "mordant," which varies in composition according to the class of dye in which the silk is later to be treated.

Spacious rectangular copper baths, generally about 2 ft. in depth, 2 ft. in width, and varying in length from 3 ft. to 8 ft., are used for the dyeing operations. These tanks are known as "dye barcs." They are first filled up with the water in which the silk was originally boiled and which, therefore, contains the gum and soap involved in that operation. The requisite dye-stuff is then added.

When the mordanted skeins of silk are ready for dyeing they are hung from long poles placed laterally across the tank top, so that the suspended skeins are immersed in the cold liquid for about three-quarters of their length. All the sticks are placed across one end of the tank.

As soon as all the skeins are immersed, the dyer commences to turn them in order that the unsteeped portions of the skeins may be immersed without delay. Beginning with the first of the sticks, he draws it slowly away from the others, grasps the first skein on it and, lifting it up, inclines it slowly and permits the undyed end to drop gently into the dye bath. When all the skeins on the first stick have thus been turned, he slowly pushes the stick along to the other end of the tank. The skeins on each stick are treated in this manner and when the last loaded stick has been fully dealt with the dyer moves round to the other end of the barc and begins over again. This monotonous task is continued until dyeing is completed.

When sufficient time has elapsed for the skeins to have become thoroughly saturated, steam is injected into the barc and the temperature of the liquid slightly raised. In the intervals of turning the skeins the temperature of the dye bath is gradually raised until ultimately boiling point is attained.

When the dyer is satisfied that the skeins are dyed to the correct degree of colour they are removed from the barc and thoroughly rinsed in clean water. After having drained awhile each skein is wrung to remove from it as much liquid as possible. One end of the skein is then hung on a wooden wall-peg and a clean stick passed through the other end. By twisting the stick forcibly the skein is very thoroughly wrung, and this apparently brutal treatment considerably enhances the lustre of the dyed silk. A final test for colour is then made and if satisfactory the skein is sent to the drying room, and when dried is ready for weaving.

The complicated weaving machinery of a modern silk factory operates on the same basic principle as the earliest hand loom, that is the intersecting of two sets of threads. Each set may comprise threads of many different colours, which are intersected in varying proportions according to the pattern being woven. The threads for one set are tightly stretched horizontally on the loom and are known as the warp threads. These have to withstand a good deal of friction and strain during weaving and only thread that has been strengthened by considerable twisting during "throwing" is used as warp. The threads comprising the other set are termed weft threads, and as these are not subjected to any great strain they do not require to be twisted to quite as great a degree. In consequence of the gentler treatment accorded to it during the throwing process weft is softer and more lustrous than warp.

The earliest improvements in the early hand loom were those

made in connection with the part known as the shuttle. The interweaving of the warp by the weft, which is called the "picking motion," is effected by passing a weft thread from the shuttle between some of the threads of the warp. The shuttle moves from one side of the loom to the other and each time it passes between the threads of the warp it leaves behind a thread of weft.

Three distinct operations are necessary to enable the shuttle to accomplish this movement. The first is the opening of the warp, when some of the threads are raised for the second operation of picking. The third operation, which is called "beating up" the weft, consists of pressing the weft into position by what is known as a "rib." These three primary operations must be carried out on every loom, no matter whether it be the hand loom of a cottager or the largest power loom used in a modern factory.

Up to the early part of the 18th century the shuttle had to be "thrown" backward and forward by hand, and this was accomplished by two persons who stood one on each side of the loom. As the shuttle was heavy, the task of throwing it was hard work as well as being a very slow process. In 1750 John Kay of Bolton brought about a great improvement by his invention of the "flying" shuttle. This invention consisted of a "picking stick" that drove the shuttle backward and forward and saved the weavers from throwing it with their hands. Not only did this invention greatly decrease the labour involved, but also it increased considerably the production of the looms.

In early methods the simultaneous raising of certain warp threads for the passage beneath them of a weft was effected by an assistant operator who was known as the cord-puller. It was his task to recognise which of the many warp threads had to be raised for each weft movement and to pull on them simultaneously. This method of operation was, of course, very slow and laborious.

During the 18th century, Basile, Bouchon, Vaucanson and others devised apparatus intended to render weaving both easier and speedier, but either on account of the imperfection of their inventions or in consequence of adverse industrial conditions none of them became generally adopted. It was Joseph Marie Jacquard of Lyons who first constructed a practical mechanism that dispensed with the need of employing a cord-puller. This contrivance was patented on 23rd December, 1801, and brought about such an improvement in silk weaving that the workpeople of Lyons feared that its adoption would seriously endanger their means of livelihood. As related in the October *"M.M.,"* their fears ultimately led them to destroy Jacquard's looms, which they burnt in the market place. In spite of opposition the invention gradually became generally adopted, however, and by 1812 some 11,000 of the looms were working in France. Jacquard's looms were surreptitiously introduced into England about the year 1820.

The Jacquard mechanism comprises a cage of wood or iron formed of two small structures joined by cross pieces. The cage is securely fitted in the upper part of the loom at a height sufficient for the cords depending from its hooks and reaching as far as the edge of the warp to be inclined at only a small angle. A diagram of the mechanism is shown on this page. The hooks E are of iron wire, and are of the shape shown, being bent back in the lower part and forming a beak at the top. They are arranged vertically in the mechanism and form several ranks or series each containing from about 25 to 100 hooks. The total number of hooks varies from about 100 to 1200 or 1500. The lower part of the hooks rests on the comber-board F that forms the bottom of the cage and is pierced with holes corresponding to each hook. Through each of these holes is passed a collar G, formed of a small loop of twine, which is hung from the hook and joined at the bottom to another hook to which are attached the cords B, running to the threads that the hook is to work.

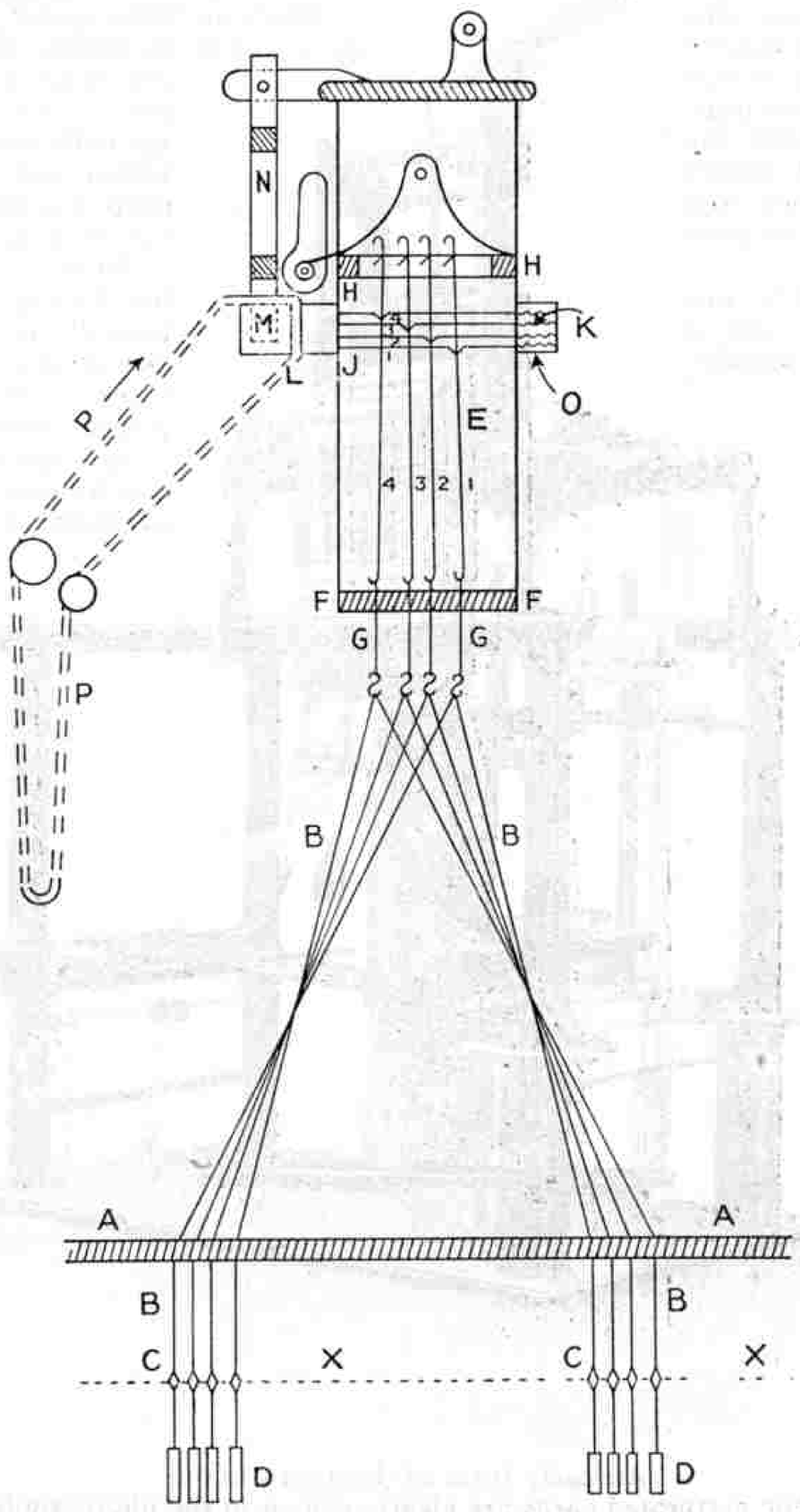


Diagram explaining the operation of the Jacquard mechanism

The hooks are attached at their upper ends to the board H, called the "griffe," which can be raised vertically against the framework of the cage by the action of a set of pulleys or levers worked from the motor shaft. The griffe carries, opposite each series of hooks, a blade of sheet-iron or steel, called the knife, which takes part in their movements. It will readily be understood that, if the griffe is raised, the beaks of the hooks will be engaged by the knives, thereby raising the hooks and the threads that they control, by means of the guides and eyelets. But each rise of the griffe would thus produce the raising of all the warp threads, and therefore cards and needles intervene in order to keep certain warp threads down as required by the particular texture of the cloth.

The needles J are slender rods of iron wire arranged horizontally and each corresponding to a hook. Each cross-wire has at its head an oblong eye through which passes a pin securing the wire in the spring box O, wherein the wire presses against one of the small springs K. The wires are guided near their right extremity by holes pierced in the cross-piece, or needle-board L. In consequence of this arrangement, each needle is able to bring about the raising or lowering of a hook, according to whether this needle is left free or thrust toward the right.

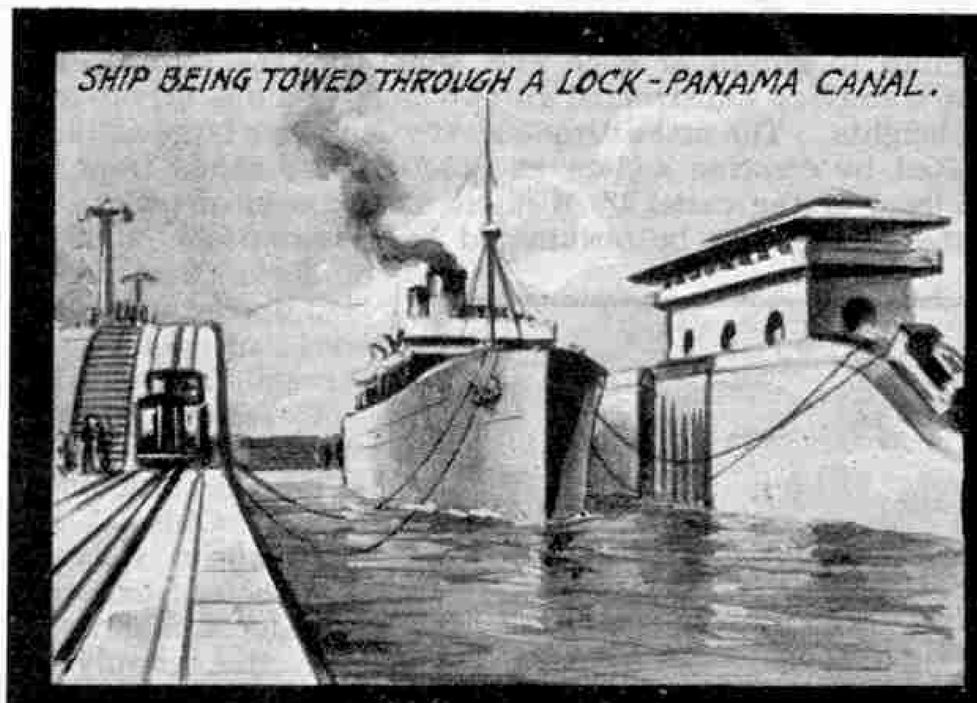
The cards P produce this action on all the needles at once, at the moment of each rise of the griffe. For this purpose, opposite the needle-board, is a prism M (often called the cylinder) carried by a chassis N, and which, through a roller acting on a slide-piece, applies one of its faces to the needles when the griffe is at the bottom of its stroke. When the griffe rises, the prism draws away from it to make a quarter-turn in order to present another of its faces to the needles for the next action. The four faces of the prism are pierced with holes coinciding with the level of the needles, so that each needle enters a hole without undergoing any interference. For each weft to be used a card is prepared that is of the same dimensions as the face of the prism and can be exactly fitted to it, being kept in position by clasps. This card covers the holes of the prism and consequently repels the ends of the needles, thus bringing about the lowering—or more exactly non-rising—of the hooks.

To regulate the passage of a weft *above* certain threads and *below* others, it is sufficient therefore to prepare a card, leaving it plain opposite those needles that command the hooks and threads that are to remain in their normal position, and piercing holes corresponding to those on the prism opposite the needles associated with the hooks and threads it is desired to raise. In this manner as many cards as there are wefts in the weft-combination are prepared and these are connected together to form an endless chain. When the loom is in operation the cards are successively brought up by the rotation of the prism and thus regulate the movement of the needles.

Minor improvements have been effected from time to time in the Jacquard mechanism. The spacing of hooks has been reduced, for instance, thus diminishing the dimensions of the cards and other parts. So sensitive is the modern loom that the strong perforated cards have been replaced by perforated ordinary paper.

Silk is woven into many different fabrics varying from dress materials of fine texture to the much stronger fabric used for balloon and airship envelopes. In addition to cloths manufactured exclusively of silk, considerable quantities of the latter are nowadays interwoven with cotton, the silk imparting strength to the cloth. Silk is similarly used in the weaving of certain woollens, rendering them lighter in weight than those woven entirely from wool.

In our articles on Silk we have dealt with the natural product only, and the so-called Artificial Silk will be the subject of a future article.

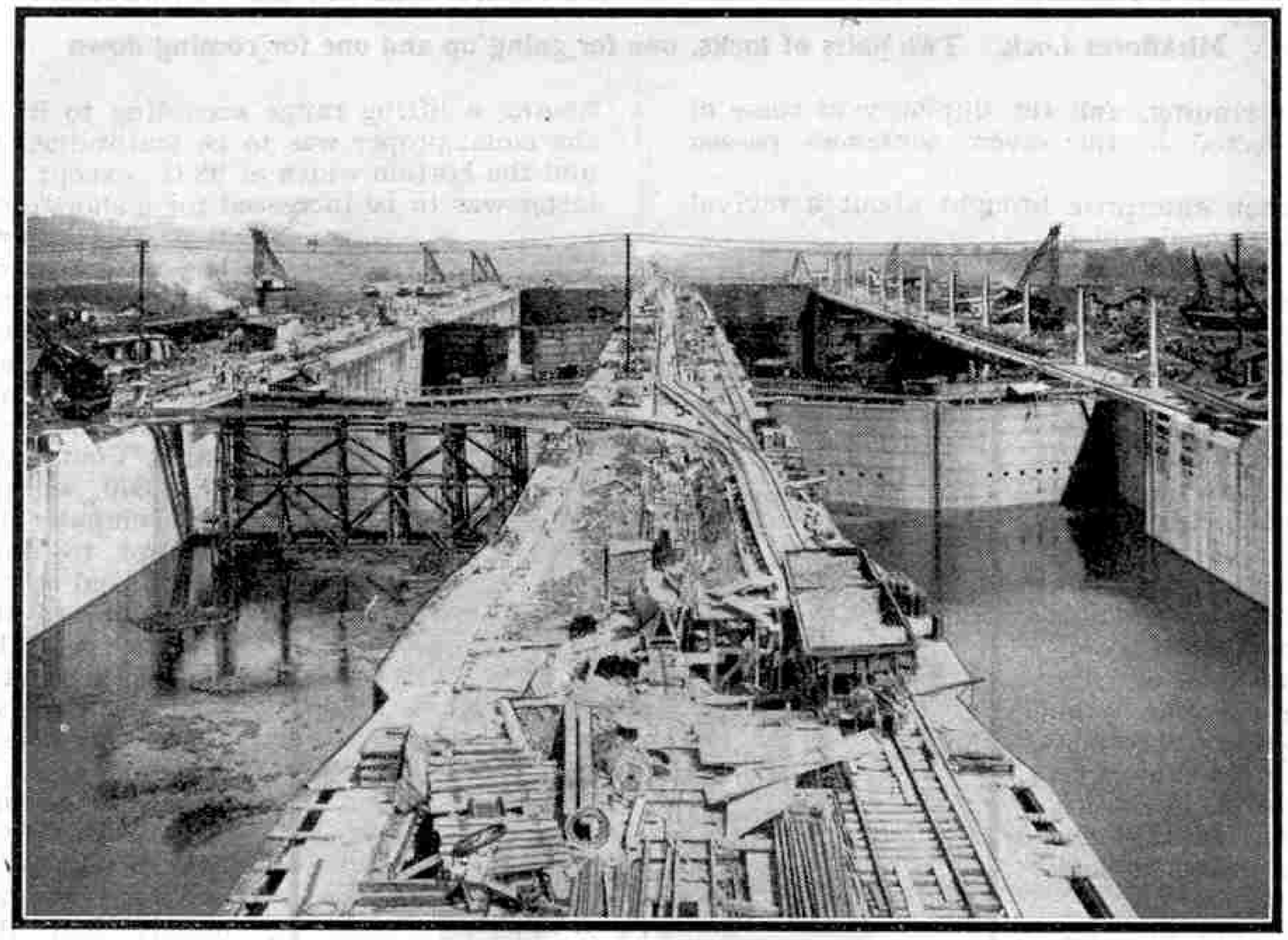


FAMOUS CANALS OF THE WORLD

VI.—PANAMA CANAL

IN last month's issue we showed how seriously de Lesseps had underestimated the engineering difficulties involved in cutting the Panama Canal, and how his miscalculations resulted in repeated revisions of his estimates of the time and money that would be required to complete the undertaking. To these purely engineering difficulties was added another that apparently had not been taken into consideration at all, and this was the havoc wrought by the fever-carrying mosquitoes that swarmed throughout large areas of the Isthmus.

The majority of the workpeople had been specially imported to carry out the scheme and, not having had time to adapt themselves to the new climatic conditions, they fell easy victims to the terrible epidemics of fever and cholera that swept at intervals through the camps of the Panama Canal Company. At Colon and Panama substantial hospitals had been built, but it was not long before every camp became a hospital. Desperate efforts were made to combat the ravages of the disease, but with little success, mainly on account of lack of knowledge of the manner in which the disease was spread and to a considerable extent also on account of a water supply that was very seriously contaminated.



The Gatun Locks (south end) in course of construction

Most of the unfortunate victims were French labourers who had been beguiled from the friendly climate of their own country to the tropical conditions of the Isthmus by visions of adventure and promises of big earnings. Their disillusionment was tragic. As the mosquitoes and insanitary conditions continued month after month to take heavy toll of life, fever became a dreaded spectre to engineers and workmen alike and the Isthmus became known as the "White man's grave-yard."

In the meantime work on the canal continued, but with painful slowness. A large amount of equipment was transported to the Isthmus and brought into use, including 72 excavators and 24 dredgers, in addition to steam cranes, locomotives and rolling stock. By the end of 1887 the canal had been wholly or partly excavated for a distance of about 10 miles inland at the Colon end and for nearly four miles at the Panama end, while some progress had been made in dredging a deep-water channel through each of the terminal harbours. In the Chagres Valley very little had been achieved, however, for there operations had been seriously delayed during the rainy seasons by the swamping of the works by the flood waters of the River Chagres. In the Culebra Hill locality also very little had been done. In short, in the course of 6½ years less than two-fifths of the canal had been constructed.

A feeling of hopelessness brooded over the whole enterprise, while the barely concealed discontent of the French labourers was a menacing undercurrent of which all were conscious. De Lesseps had to admit that, under the conditions then existing, it would be an almost insuperable task to cut a sea-level canal across the Isthmus and, realising that he must do something drastic to avert a complete collapse of his scheme, he regretfully gave up his original plan and decided to construct a canal having a series of four locks on each slope of Culebra Hill. The summit level of the canal through the Culebra cutting was to be 125 ft. above Atlantic level.

The immediate effect of this change of plan was to reduce the amount of necessary excavation through Culebra Hill by approximately 85,000,000 cubic yards, but against the substantial saving in labour and money that this represented had to be reckoned the necessity of constructing eight locks. This item in fact increased de Lesseps' estimate of the entire cost of the canal, and he now placed this at £65,500,000, as against his first estimate of £34,000,000.

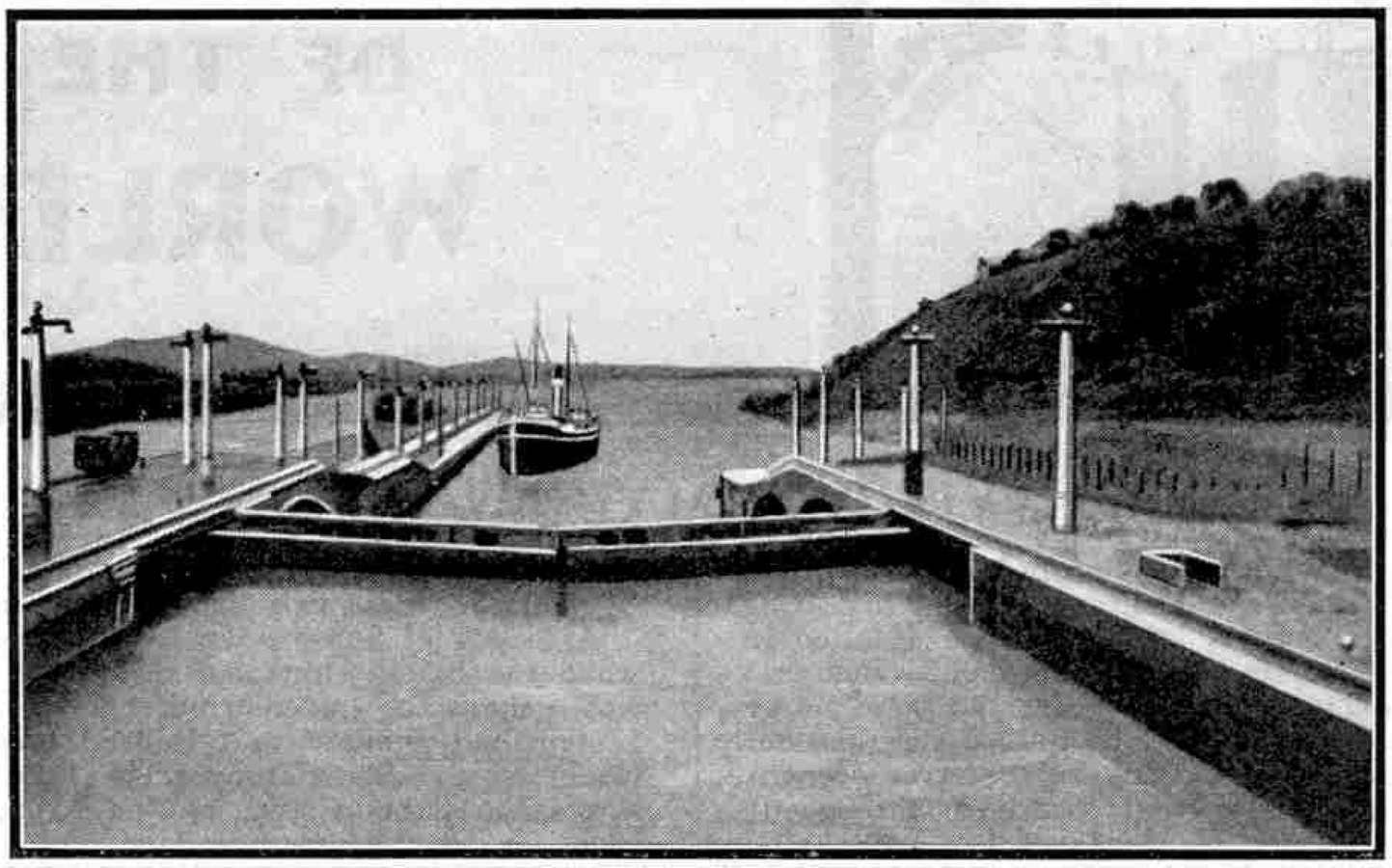
The depressing reports that for a long time had been finding their way from the Isthmus to France had gradually weakened the French public's confidence in the famous engineer, and money was no longer liberally poured into the coffers of the Canal Company. The utter lack of enthusiasm with which de Lesseps' latest proposal was received must have given him warning of how slender had become the nation's trust in him. Worse was to follow, however, for a year later the inevitable happened and the Canal Company became bankrupt.

The financial collapse of the company created a painful sensation throughout France, where it brought utter ruin to thousands of families. On 2nd February, 1889, a City Tribunal at Paris declared the Canal Company to be officially dissolved and appointed a liquidator, who gradually closed down the activities at the Isthmus by withdrawing the workpeople in weekly batches. By May in the same year operations were brought to a complete standstill.

A public demand arose for the trial of de Lesseps and eventually he was arrested on a charge of having fraudulently used the funds of the Canal Company. The official inquiry into the affairs

of the company lasted a considerable time and some startling disclosures were made. Of the enormous sum that had been sunk in the undertaking—approximately £100,000,000—only about one-third had been spent directly on the canal works. Of the remainder, one-third had been wasted and the other third misappropriated. Many of the officials had been paid utterly preposterous salaries and had lived on an almost incredible scale of extravagance. One official had a pigeon house built that cost the company £3,000 and another man erected a bath house costing £8,000. In addition, the huge consignments of goods sent out to the canal zone included a most amazing collection of utterly useless articles such as snowshoes, grand pianos, and a large cargo of hairpins!

In 1893 de Lesseps was sentenced to five years' imprisonment, but on account of his advanced age—he was then 88—and his past honourable record the sentence was never enforced. To some extent de Lesseps had been more sinned against than sinning, and the duplicity of some of his subordinates was reflected in the severe sentences passed upon them.



Miraflores Lock. Two pairs of locks, one for going up and one for coming down

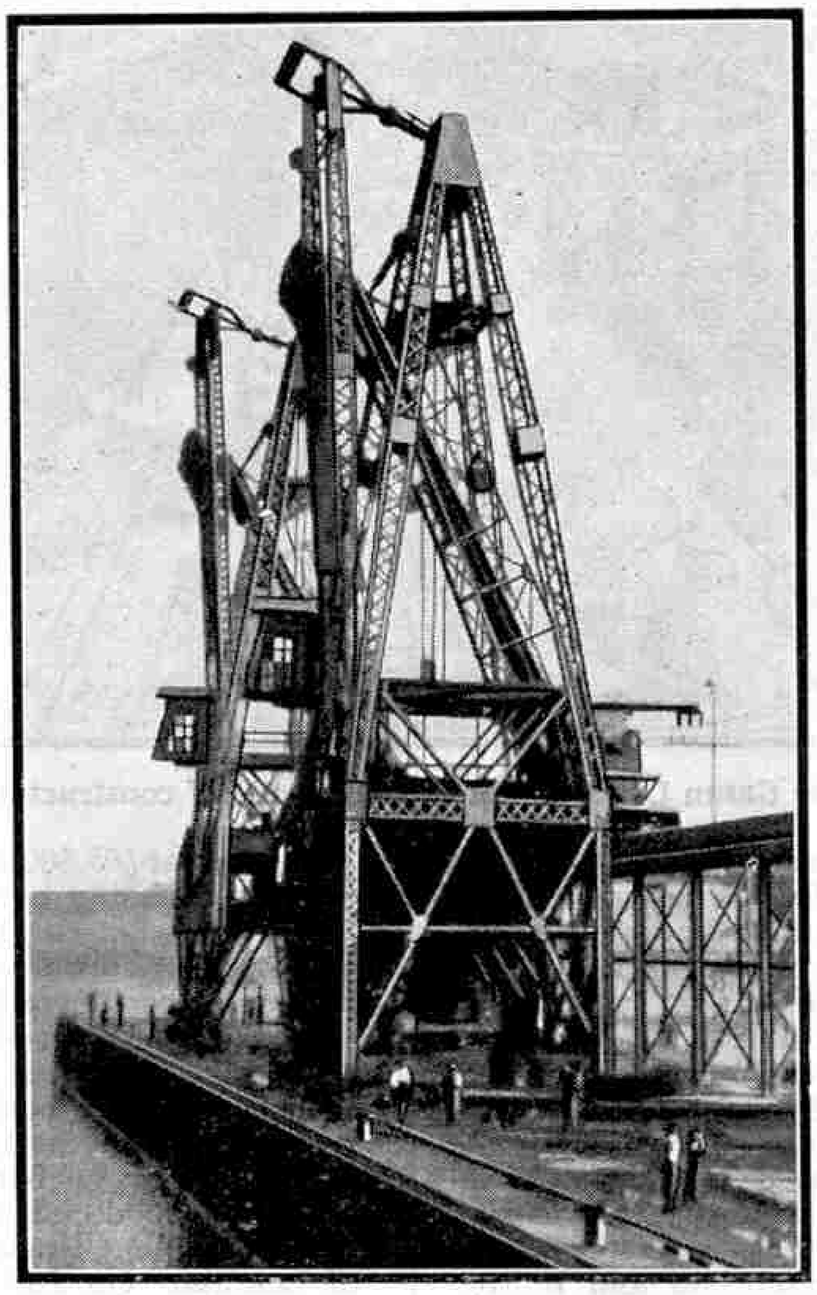
The collapse of the French enterprise brought about a revival of American interest in the canal project and in 1887 a survey party was sent from the United States to Nicaragua. So favourable was their report of the country through which it was proposed to construct a canal that in the following year a company was formed under the name of "The Maritime Canal Company," and it was not long before men and materials were being transported to the Nicaraguan Isthmus. Wharves and warehouses were erected at Greytown, where a breakwater for the protection of ships chartered by the company was also constructed. By taking advantage of Lake Nicaragua and adapting the San Juan River, the estimated amount of necessary excavation was reduced to 28 miles, out of a total length of canal of 170 miles. Work was commenced, but in 1894 the scheme collapsed, chiefly owing to lack of funds.

This American effort served to determine the French to complete their Panama scheme before the project was rendered of small importance by the construction of an oceanic canal across some other part of Central America. Thus it was that, in the year the American company failed at Nicaragua, a second or New Panama Canal Company was formed in France with an initial capital of £2,000,000.

The Colombian Government granted the New Panama Canal Company authority to complete the abandoned works, but stipulated that the canal must be finished within ten years after 1894. The company took over all the equipment of their predecessors, engaged considerable native labour in addition to European, and resumed operations at the Isthmus, but on a very reduced scale. Very little had been done by the old company in the way of constructing the eight locks planned by de Lesseps, and the entire canal scheme was now reconsidered and substantially altered.

The revised scheme comprised a canal with a sea-level section several miles in length at each end, and with the intermediate length of waterway constructed in two long sections elevated to different heights. The first altitude level was to be a large artificial lake created by erecting a dam at Bohio, and reached from the Atlantic level of the canal by a flight of two sets of locks. At Obispo the lake was to be terminated by a second similar flight of locks that would lead up to the summit level of the canal through Culebra Hill.

A secondary dam was to be built at Alhajeula, nine miles beyond Obispo, and an artificial reservoir constructed from which a feeder would maintain the supply of water in the summit level. At the Panama end of this topmost section the canal was to be brought down to the level of the Pacific by means of four sets of locks situated at Paraiso, Pedro Miguel and Miraflores. The locks were each to have a clear length of 738 ft., a width of 82 ft., and a depth of 33 ft. 10 in. They were to be constructed two abreast, each set having a lifting range according to its situation. The depth of the canal proper was to be maintained throughout at 29 ft. 6 in. and the bottom width at 98 ft., except at certain points where the latter was to be increased for a short distance. It was estimated that this comprehensive scheme could be carried out for some £21,000,000, including the cost of diverting 31 miles of the Panama Railway from its route through the Chagres River to a course bordering the new lake.



Coaling Stage at Colon

From 1895 onward the New Panama Canal Company employed from 2,000 to 2,600 workpeople at the Isthmus. The company did not make any serious attempt to improve the conditions of living and the progress of the canal works proved slow and costly, although the native labourers principally employed did not succumb to disease as easily as Europeans.

The initial enterprise of the Maritime Company had reawakened the desire of the American people for their country to possess a State-owned and governed Atlantic-Pacific canal. Yielding to popular opinion, the Government ultimately had the Nicaraguan Isthmus re-surveyed, but without definite results. In 1899 President McKinley appointed a Commission to investigate the subject in detail, and two years later the Commission expressed themselves in favour of a canal via Lake Nicaragua, having a total length of 183⅜ miles and estimated to cost £40,000,000.

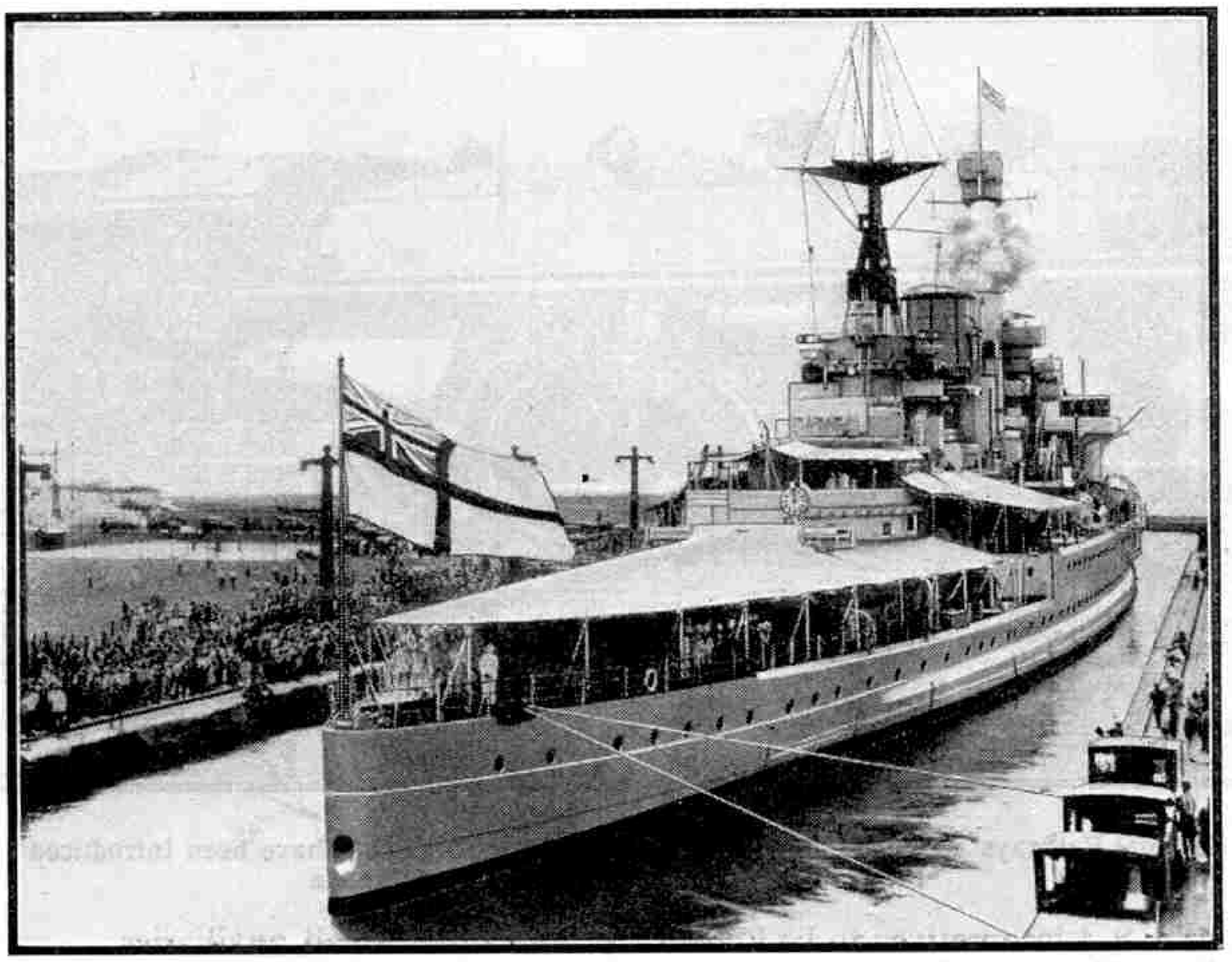
America had not lost interest in the chequered career of the Panama project and was aware that matters were not going well with the second French company. Before authorising the formation of a new American company to carry out the Nicaraguan scheme the United States Government therefore sought to purchase the Panama undertaking as it stood. The French company were only prepared to sell a half interest in their scheme, however, and the United States therefore declared their intention of pushing ahead with the Nicaraguan project.

The news of this decision was received with apprehension by the New Panama Canal Company, for if the Nicaraguan Canal

were to become a reality—and backed by American enterprise and ample funds it had every prospect of doing so—the ultimate prosperity of the Panama Canal would suffer a severe blow. America was prepared to pay 40,000,000 dollars for the canal undertaking, which was barely one-sixteenth of the money so far expended on the scheme and considerably below the figure at which the French company were prepared to sell.

Then America learned that the concession granted to the company by the Colombian Government expired in October 1904, and that if the canal were unfinished at that time it would become the property of Colombia, unless the concession were renewed. America therefore decided to wait until that date in the hope of then being able to negotiate with Colombia, rather than continue the present haggling with the unwilling French owners.

The Panama Company now realised that unless they accepted America's offer they would not only ultimately lose the canal, for it was evident that this would not be completed before the concession expired, but would also lose the 40,000,000 dollars. They decided to make the best of a bad job therefore and, obtaining Colombia's permission to sell out to America, offered the canal undertaking to that country for 40,000,000 dollars. The offer was promptly accepted and in March 1903 the whole Panama scheme was officially signed over to the United States.



The H.M.S. "*Renown*," on which the Duke and Duchess of York toured the world, in the Gatun Locks at Panama

Complications now arose on account of the refusal of Colombia to agree to the United States assuming perpetual control of the three mile wide strip of land on each side of the canal that had been granted to the New Panama Canal Company. The difficult situation thus created was unexpectedly relieved in November of the same year, however, by Panama revolting from Colombian Government and declaring itself an Independent State.

The revolution was a very mild affair, as revolutions go. The trouble had been brewing in the Province of Panama for a long time and the revolutionists finally decided to strike their blow on 4th November, 1903. The Colombian Government authorities got wind of the affair, and on 3rd November a Colombian steamer arrived at Colon with five generals, all magnificently attired in full war regalia, and 450 soldiers, many of whom were accompanied by their wives! General Torves was left in charge of the troops, who camped out in the streets of the town, while General Tovar, the commander of the contingent, and three other generals entrained immediately for Panama, with the intention of creating awe in the hearts of the revolutionists.

Word was received at Panama that the four generals were on their way and preparations were hastily made to "welcome" them. On arrival at the barracks they were very courteously received but the warmth of the welcome died suddenly when General Huertas, one of the most stalwart of the revolutionists, stepped forward and ordered General Tovar to surrender his sword. The refusal of the latter was followed immediately by the arrest of himself and his fellow officers.

The die had now been cast and the revolutionists, feeling rather uneasy, realised that they must go through with their venture. Their nervousness was due partly to doubt as to the attitude of three Colombian gunboats stationed outside the harbour, and when the revolt was duly announced to the boats their reply was anxiously awaited. Two of the gunboats remained silent, but the third, named the "*Bogota*," replied that if the captive generals were not released by 10 o'clock the city would be bombarded. At 10 o'clock the generals were still locked up. The "*Bogota*" therefore manœuvred into position, fired three shells into the city—and then steamed away! A Chinese coolie near the barracks was killed, but he had the distinction of being the only fatality during the revolution!

On the following morning one of the two remaining gunboats decided to forsake the Colombian cause and hoisted the flag of the revolutionists; the other boat presumably steamed away.

When General Torves at Colon learned of the imprisonment of the four generals he immediately attributed it to American interference and announced that he would kill every American in Colon if General Tovar were not speedily released. So threatening did Torves become that 40 marines were landed from the American cruiser "*Nashville*," then anchored off Colon. Matters looked very ugly for a time. Torves demanded a special train to transport his troops across the Isthmus to Panama, and the superintendent of the line informed him that he would be pleased to provide a train—provided that the general would pay for it! The latter had not sufficient cash in his possession to pay the fares of 451 people, which would have amounted to about 2,000 dollars in gold, and he therefore retired defeated! On seeking to telephone and telegraph to his imprisoned comrades he was told that both systems were out of order.

Later the revolutionists offered Torves 8,000 dollars to remove himself and his men from Colon and he accepted the bribe. The contingent in due course left for home, embarking on the Royal Mail steamer "*Orinoco*." The general's negotiations with the revolutionists later became known to his troops and they expressed their contempt by forcibly relieving him of the money! Shortly after the party left Colon a special train drew up at the station and four very subdued-looking generals alighted. At Panama they had faithfully promised to be good and go home quietly and had thereupon been released!

A Republican Government of Panama was formed without delay. On 7th November Banau Varilla, an able French civil engineer who had been associated with the canal operations for many years and had also been one of the prime movers of the revolution, was appointed Envoy Plenipotentiary of Panama to the United States, and immediately took up his duties at Washington. Panama's new Government was, of course, wholly in favour of America taking over the canal enterprise and finishing it off in a prompt and efficient manner, and Varilla's appointment resulted in the signing of the Banau-Varilla Treaty on 18th November the same year. This treaty gave America perpetual occupation and control of a strip of land 10 miles in width—five miles on each side of the canal—extending the entire length of the canal and for three miles out to sea at the Atlantic and Pacific termini.

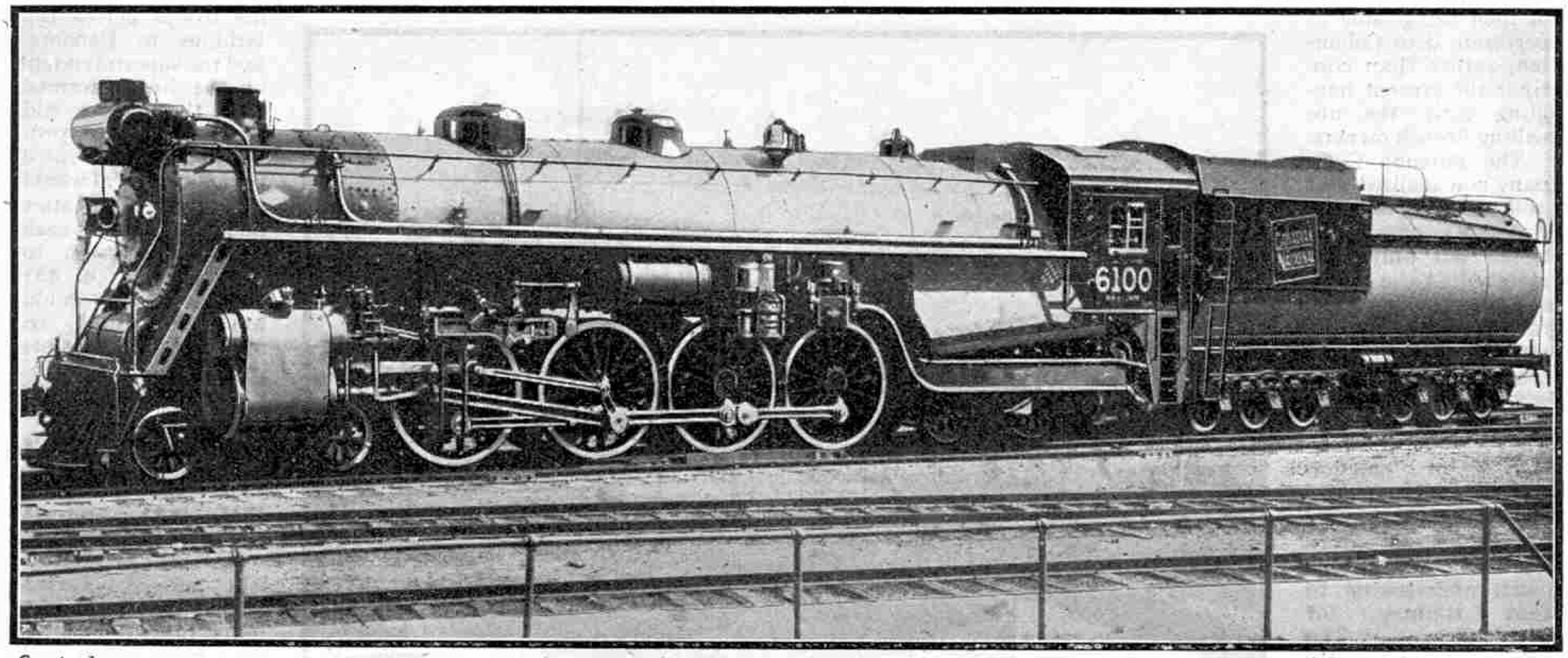
In May 1904 America took over from the French the actual control of the canal works, and thus France passed out of the affair completely.

The equipment purchased by America included, of course, the Panama Railway, and this the American engineers found to be sadly disorganised. Upon its efficiency depended the quick transport of men and materials between the various scenes of operations, and therefore new rolling stock and a large quantity of rails were included among the necessary materials shipped to the Isthmus as a prelude to the campaign.

The preliminary operations were watched with keen interest by the people of the newly made Republic and it was quickly realised that this time the enterprise was being tackled in a really practical spirit, and that it would be carried through to a successful finish. Next month we shall describe how the difficulties that had proved too much for the French companies were overcome and the Panama Canal completed.

Monster Canadian Locomotives

Interesting Comparison with those of 60 Years Ago



Courtesy [*C.N.R.*

The first of the Canadian National Railways' new "6100 Northern" type locomotives that have been introduced to celebrate the Jubilee of the Confederation of the Dominion of Canada

THE first of 40 giant 4–8–4 locomotives to be known as the "6100 Class, Northern Type" has been placed in service on the Canadian National Railways' line between Montreal and Toronto. This new monster, which pulls a steel train of 16 Pullman coaches at 90 miles an hour, is 15 ft. 3 in. in height and measures 39 ft. 10¾ in. from the tip of the "cow catcher" to the tail of the tender. The engine with its empty tender weighs 319 tons. Twenty of these engines are being built by the Canadian Locomotive Company, Kingston, and 20 by the Montreal Locomotive Works, both orders being identical with the exception of a few details. The engines are designed for either passenger or fast freight service.

The boiler is of the straight top type with radially stayed firebox and is built to carry a pressure of 250 lb. per sq. in. The cab is a short vestibule all-steel type, wood lined, with C.N. standard turrets placed ahead of the cab. The left-hand turret is supplied with superheated steam by a 3 in. pipe leading from a connection on the superheater header, while the right-hand turret is supplied with saturated steam from a direct connection to the boiler. Superheated steam is supplied to the air pump, feed water heater pump, stoker and headlight generator; while saturated steam is supplied to the inspirator, lubricator and other small auxiliaries.

An interesting feature is the location of the whistle, which had to be placed at the left-hand side of the smokestack as far from the cab as possible, in order to prevent the driver and the fireman being rendered deaf by its shriek when the train is travelling at high speed!

The "6100 type" engine has been designed by the Motive Power Department of the Canadian National Railways and represents an increase of 20 per cent. in tractive power over the "6000 type" engine which, at the time of its introduction, was the largest passenger locomotive in the world.

In designing the new locomotives the engineers of the C.N.R. have kept in mind the peculiar requirements of railway operation in Canada. Climatic conditions, ranging from intense summer heat to severe winter cold, create problems of considerable difficulty. The new engines therefore have been built to permit of their being worked with a high degree of efficiency throughout the complete range of weather, even in blizzards and heavy snowstorms.

These are the first Canadian engines to bear a distinctly Canadian name. Previously, Canadian-built engines have been based on the designs of some other well-known type, such as the "No. 6000," the "41000," and the "Santa Fé,"

The leading dimensions and weights of these new engines are as follows:—

Cylinder	25½ in. × 30 in.
Driving Wheels—Dia.	73 in.
Boiler—Outside Dia.	90 in.
Working Pressure	250 lb.
Firebox	126⅛ in. × 96½ in.
Wheelbase—Engine ...	43 ft. 10 in.
Wheelbase—Engine and Tender ...	82 ft. 0 in.
Weight of Engine (Booster fitted) in working order	388,000 lb.
Weight of Tender	260,000 lb.
Heating Surface:	
Tubes and Flues	3,814 sq. ft.
Firebox	315 „
Syphons and Arch Tubes ...	117 „
Total	4,256 „
Superheater	1,700 „
Grate Area	84.4 „
Max. Tractive Power, engines only	56,800 lb.
„ „ „ with booster	69,700 lb.
Capacity of Tender—Water	11,300 Imp. Gals.
„ „ —Coal	20 tons

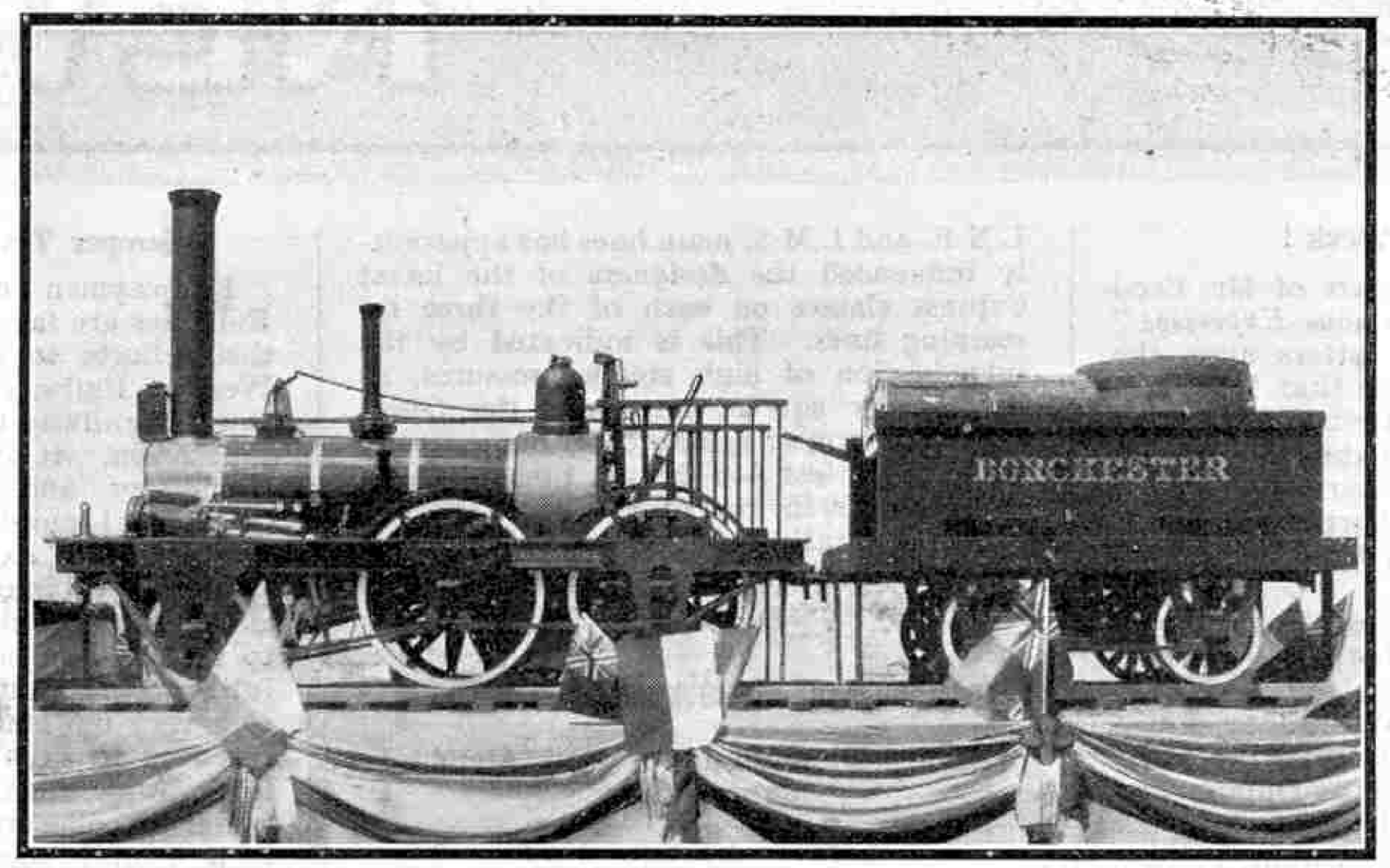
but the "6100" is to be known as the "6100 Class, Northern Type," a name that clearly indicates the part of the American Continent in which it was developed.

The new engines are to be used on such important runs as that made by the "*International Limited*," from Montreal to Sarnia, a distance of 511 miles, in covering which a Canadian record will be set up for the longest run without a change of engine. To facilitate this long run special coal chutes have been built at various points along the line. Engines of the new type will also be used for the Grand Trunk Western lines and on the international trains running between the principal cities of Eastern Canada and the United States.

It is interesting to compare these huge locomotives with our own Great Western Company's "*King George V*," which, complete with tender, weighs 136 tons, 14 cwt. In spite of the extraordinary disparity in weight—nearly 150 tons in the booster-less type—there is a gain of only 16,500 lb. in tractive effort.

Another and in some respects even more interesting comparison is afforded by a study of our illustrations, the second of which shows a half-size model of the Canadian National locomotive "*Dorchester*." This was the first locomotive ever used in Canada and was constructed in England by Robert Stephenson & Co. It was shipped to Montreal for service on the Champlain and St. Lawrence Railway, the first Canadian line, built in 1835. This line, which was 16 miles in length, ran from Laprairie, on Lake Champlain, to St. Johns in Quebec, and now forms part of the Canadian National Railway system.

The original line was a "portage" road, designed to shorten the distance between Montreal and New York. The route, via the Richelieu River, was a natural artery of trade between the two countries in early days, and was first used by Indians. Later the French and other colonists used it for trade and war, while in revolutionary days it was followed by the Americans when they invaded Canada. The river of St. Johns is now spanned by several bridges, over one of which C.N.R. trains pass daily to and from New York, following a line that is practically parallel with the original water route.



Courtesy] [*C.N.R.*

A half-size model of the wood-burner "*Dorchester*," the first locomotive used in Canada

Our illustration shows a model of the "*Dorchester*" mounted on a lorry at an exhibition in Montreal. It will be seen that the locomotive was a wood-burner and carried its water in a barrel at the rear of the tender.

An interesting illustration of railway progress in Canada is furnished by a comparison between another wood-burning locomotive that ran on the Grand Trunk Railway 60 years ago, and the "6100" type of to-day. The boiler alone of the "6100" is almost equal in size to the complete engine of 1867. The latter could only haul four passenger coaches and from 10 to 15 freight cars on the level, whereas the new monster makes light work of 16 passenger coaches or 150 heavy freight cars.

Another interesting comparison is to be found in the smoke stacks of the two engines. That of the old wood-burner towered 14 ft. 10 in. above the track, flaring at the top like a glorified cement mixer; the new locomotive has a low and squat smoke stack, giving an impression of immense power and speed.

This new locomotive possesses the distinction of having been driven by Mr. Stanley Baldwin, the Prime Minister, during his recent visit to Canada.

Competition Results

No. 2 Outfit (Overseas Section)

The following are the results in the Overseas Section of the special Meccano Competition for models built from the contents of a No. 2 Outfit :—

FIRST PRIZE (Meccano products to value of £3-3s.): Charles Roger, 55, rue de Turenne, Paris, III.

SECOND PRIZE (Meccano products to value £2-2s.): Gordon H. F. Bartlett, Bowen Terrace, Brisbane, Queensland.

THIRD PRIZE (Meccano products to value £1-1s.): I. K. Menon, Tellicherry, Malabar, S. India.

SIX PRIZES, each of Meccano products to value 10/6: F. J. A. Nash, Gibraltar; Salvatore Galdes, Valletta, Malta; J. W. M. Yorston, Dunedin, New Zealand; J. Sunderland, Newcastle, N.S.W.; C. Marchison, Melbourne, Australia; P. T. Hewitt, Geneva.

SPECIALLY COMMENDED (Certificates of Merit): S. Wreford, South Canterbury, New Zealand; A. Sinclair, Toronto, Canada; M. Ruskjer, Alta, Canada; P. Grant, Johannesburg, S. Africa; W. L. Holcroft, East London, S. Africa; E. Holder, Port-of-Spain, Trinidad; D. McDonald, Annotto Bay, Jamaica.

The First Prize-winning model represents a mobile crane—a particularly interesting subject for Meccano models. A crane of this type will travel anywhere where a petrol lorry can go, and it is used to a large extent in factories and engineering works on account of the considerable saving that it effects in handling costs. The crane may be run alongside a railway wagon, for example, and used to load a lorry, thereby obviating the necessity of shunting the wagon under a fixed crane.

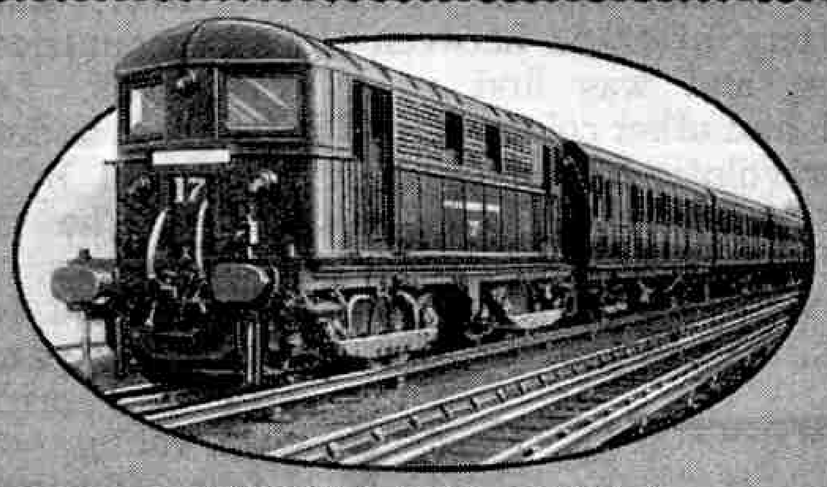
G. H. F. Bartlett submitted a model vertical drill in which he has incorporated an ingenious method of lubrication, while I. K. Menon obtained Third Prize with a model railway velocipede. As most Meccano boys know, the latter apparatus resembles the frame of an ordinary bicycle mounted on four flanged wheels, which run on the railway lines. The machine is propelled either by pedals in the same way as in a bicycle, or by hand levers.

Meccano Bevel Gears

Readers are requested to note that part No. 30b, $\frac{3}{4}$" diam. Bevel Gear, has been withdrawn from circulation in view of the fact that a right-angle drive giving a ratio of 1 : 1, for which this part was originally designed, may be obtained satisfactorily by using two of the existing $\frac{7}{8}$" Bevel Gears, part No. 30.

The $1\frac{1}{2}$" Bevel Gear (No. 30c), which was illustrated in the October "*M.M.*," is now supplied with eight holes punched in its face. This alteration adds considerably to the adaptability of the part.

The $1\frac{1}{2}$" Bevel Gear is designed to mesh with the $\frac{1}{2}$" Bevel Gear (No. 30a) only, and these wheels when used in this way provide a speed ratio of 3 : 1. Part No. 30a will not mesh correctly with a like part, nor will 30c; they are intended for use only with each other.



A METROPOLITAN TRAIN

RAILWAY NEWS

Over 2,000 a Week !

Many enthusiastic readers of Mr. Cecil J. Allen's articles on "*Famous Expresses*" have remarked in their letters upon the large amount of travelling that Mr. Allen must have done. It is probable that few readers have any idea of the ground that he actually covers, however. In a letter written to the Editor a short time ago Mr. Allen gave the following brief description of a week's journeys :—

"I have had a rare 'busman's holiday' this week. Monday, footplate to Plymouth and back to London; Tuesday, London to Edinburgh; Wednesday, Edinburgh-Carlisle-Glasgow-Stranraer; Thursday, Stranraer-Larne-Belfast-Dublin and broadcasting from Dublin during the Children's Hour; Friday, Dublin-Belfast, visit to a linen works, on the footplate Belfast to Dublin, over to Holyhead Friday night—and a nice rough night, too !—and home to breakfast here (Barnet) this morning."

As Mr. Allen remarks, this was "some" week for travelling, the total mileage being just over 2,000 ! It may interest readers to trace out the various journeys on the map.

* * * *

Standard British Express Locomotives

With the placing in service of the first of the new "Royal Scot" class express locomotives by the London, Midland and Scottish Rly., it may be said that each of the four great railway companies now possesses a type of express engine that will remain for a considerable time the largest and most powerful on the respective lines. Added force is given to this statement by the announcement of the L.N.E.R. that a new series of ten "Pacifics" of the well-known "Flying Scotsman" type is being built for express passenger work between King's Cross and the West Riding of Yorkshire, and over the Waverley Route between Edinburgh and Carlisle.

One of the original "Pacifics," No. 4480, "*Enterprise*," has been rebuilt with a new boiler pressed to 220 lb. per square inch and slightly modified Walschaerts valve gear. The weight of the engine has been increased by two tons per driving axle (necessitated by the heavier boiler now carried) and its tractive effort from 29,835 to 36,465 lbs. As rebuilt, "*Enterprise*" has improved upon even the record exploits of this celebrated type, and in addition to the ten new engines all members of the class will be similarly rebuilt as they are taken off for heavy repairs.

It is interesting to note that the record work performed by Great Western "Castle" type engines when running trials over the L.N.E. and L.M.S. main lines has apparently influenced the designers of the latest express classes on each of the three remaining lines. This is indicated by the introduction of high steam pressures, as 225 lb. per sq. in. has been the Great Western express standard for some years, while the latest 4–6–0's are pressed to no less than 250 lb. per sq. in.

A comparative dimensions table of the new standard express engines of the four chief railway companies is given herewith.

R.S.M.

Leading Dimensions of New Standard Express Locos

Loco	L.M.S. "*Royal Scot*"	L.N.E.R. "*Enterprise*"	G.W.R. "*King George V*"	S.R. "*Lord Nelson*"
Type	4–6–0	4–6–2	4–6–0	4–6–0
Cyls.	3	3	4	4
	18″×26″	20″×26″	16½″×28″	16½″×26″
Coupled Wheels	6′ 9″	6′ 9″	6′ 6″	6′ 7″
Heating Surface Total	2526	3442·6	2514	2365
Grate Area	31·2	41·25	34·3	33
Boiler Pressure lbs. per sq. in.	250	220	250	220
Tractive Effort at 85% Pressure (in lbs.)	33,150	36,465	40,300	33,510
Weight in working order	84t. 18cwt.	96t. 5cwt.	89t.	83t. 10cwt.
Tenders	42t. 14cwt.	56t. 6cwt.	46t. 14cwt.	56t. 15cwt.

The Co-operation of Employees

Sir Felix Pole, General Manager of the Great Western Railway, states that during the year ending 31st March, 1927, over 3,535 suggestions for improvements in working were brought forward by employees of the company. The suggestions covered traffic arrangements, mechanical, engineering and signalling appliances. Since the scheme was put into force in 1913, nearly 30,000 suggestions have been put before the committee that deals with these matters.

* * * *

New L.N.E.R. Passenger Stock

The existing articulated units operating on the L.N.E.R. have proved so successful that the company have ordered four new trains composed of quintuple units, eight new trains each consisting of quadruple units, and three triple sets of restaurant cars. These new vehicles form part of an order recently placed for 259 new passenger carriages, restaurant cars, brake and mail vans. The all-electric cooking restaurant car services are to be extended by the provision of additional electrical charging stations at various large centres.

Temper Tests for Railway Men

Railwaymen on the Austrian State Railways are faced with a new obstacle to their efforts to gain promotion. In the Western Railway Station of Vienna there stands a railway carriage that never leaves the station. It contains a mass of electrical machinery and levers, and numerous mechanical puzzles designed to test the psychology of examinees. Each test has been designed in order to present exigencies closely allied in their nature to those likely to arise in the course of the candidate's future work, and the apparatus records to a very minute degree the quality of his response to each test. The tests reveal, for example, the intelligence, attentiveness, power of concentration, speed of reaction, and mental stamina of candidates for posts such as engine drivers.

One test, designed particularly for signalmen, consists of a chest of 25 small drawers, each containing a key. The candidate is seated in front of the chest and given the key to one drawer. This drawer he must find and unlock, withdraw from it a second key, find and unlock its corresponding drawer, and so on throughout the chest. The man who succeeds in unlocking all the drawers without losing patience or becoming flustered can be trusted to keep his head after a railway collision. The tests have only recently been instituted and it is intended also to examine existing employees.

* * * *

L.N.E.R. Head Code Lights

The multiplicity of lights on the Great Eastern section suburban lines is so great that the L.N.E.R. have been compelled to introduce a second colour to supplement the customary white light used for locomotive head lamps. Purple is the colour chosen, this being the only colour of sufficient penetrative power to vary unmistakably from the red, green and orange of ordinary signal lamps.

* * * *

Audible Signalling on the G.W.R.

The high efficiency attained by the audible signalling apparatus fitted on the main G.W.R. line between London and Reading, and for which over 160 passenger engines are already equipped, has led the G.W.R. Engineering Department to make the apparatus standard for all new passenger engines.

* * * *

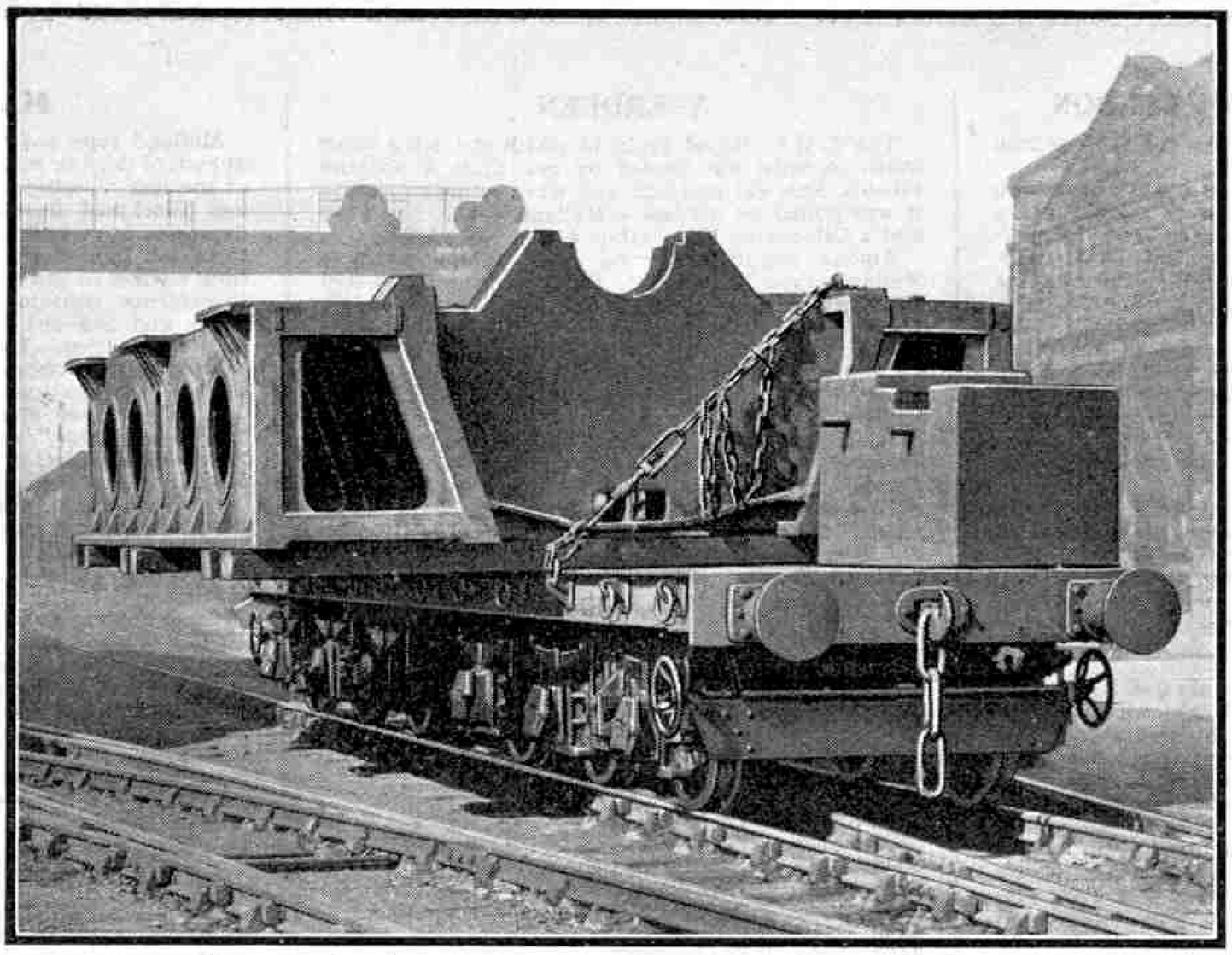
The "distant" signals on the Brighton section of the Southern Railway are being painted yellow to conform with the new standard colour for "distant" signals. The signal spectacles also are being converted to orange for the "on" position.

Moving a Large Casting

The illustration on this page shows a large bed-plate 30 tons in weight, that the London and North Eastern Company recently conveyed from Sheffield to Sunderland. The measurements of the casting are 21 ft. 7½ ins. in length, 14 ft. 7 in. in width, 5 ft. 6 in. in depth.

The bed-plate was cast at the Openshaw Works, Manchester, of Sir W. G. Armstrong Whitworth & Co. Ltd., but owing to the excessive dimensions rail conveyance could not be arranged from Manchester because of Woodhead Tunnel. To obviate this, road conveyance was arranged from Manchester to Sheffield, at which point the casting was railed.

It was loaded on one of the L.N.E. 60-ton six-wheeled bogie flat wagons and was placed out of centre to the 6 ft. side. The traffic was worked from Sheffield to Sunderland by special train on a Sunday with the opposite line clear of all other traffic. It will be seen that balance weights are in use on the truck to keep it to the rails; having regard to the excessive overhang to the 6 ft. side weights of 20 tons were required to accomplish this. The traffic arrangements for this awkward load functioned perfectly.



Moving a large casting from Sheffield to Sunderland on the L.N.E.R., as described on this page

* * *

Engine Driving Positions

From which side is a British locomotive driven? That question would puzzle a considerable number of people who claim to possess observant eyes! Actually, approximately half of the 24,000 locomotives in use on British Railways are driven from the right-hand side and the remainder from the left.

This remarkable state of affairs is due to the diversity of the practice of the different pre-"grouping" companies. The L.N.W.R., the L. & Y., the Furness, the Caledonian and L.B. & S.C., among others, standardised the left-hand drive for their engines; while the Midland, N.E., G.C., G.E., and G.W. Railways employed the right-hand drive. The grouping arrangements resulted in the locomotives of the various component companies being scattered throughout the system operated by their group. The result is that left-hand and right-hand driven engines are frequently seen operating on the same section.

The most favourable position would seem to be the left-hand side, since this places the driver in such a position that his right hand naturally lies within easy reach of the regulator handle. As new engines are being constructed the driving position is being standardised according to the practice of each of the large groups.

* * * *

Work has been started on the British Columbia Electric Railway's new power tunnel at Bridge River. Its length is 2½ miles and its estimated cost is £250,000.

Railway Advertising

A further group of statistics for 1925 in connection with the four railway groups reveals that, in addition to the many millions of excursion handbills distributed, over 8,000,000 special holiday and travel booklets were prepared and passed on to the public. The railways use the advertising columns of over 1,000 newspapers and periodicals and occupy space on 246,000 bill-posting stations.

A Relic of Trevithick

An interesting relic of the old tram road over which Trevithick ran his locomotive in 1805 was discovered during the construction of the new pipe line from the Taf Fechan Reservoir, near Abercynon. Cast-iron tram plates, 3 ft. in length, were found to be still in place, attached to the stone blocks used as sleepers in those early days. This old tram road ran from the Penydarren Ironworks to the old canal basin of the Merthyr section of the Glamorganshire canal. The Taf Fechan Water Supply Board have presented one set of the rails and blocks to the National Museum of Wales, Cardiff, and a second set to the Merthyr Museum.

* * * *

A Novel Station Show

The attention of passengers using the busy General Station at Chester was recently attracted to dishes of potatoes and other vegetables arranged for exhibition on trestle tables, neatly covered with out-of-date timetables. It was the occasion of the first exhibition of produce by members of the Chester branch, London, Midland and Scottish Horticultural Society. Most of the potatoes, which were destined for the local infirmary, had been grown within sight and sound of passing trains, so it was appropriate that they should form a much-admired exhibit on the station platform. There was keen competition for the medals awarded.

R.S.M.

The York Railway Museum

There have recently been some important and interesting additions to the Railway Museum at York. First of all there is the "*Briggs Collection*," formed by the late Mr. Isaac Briggs of Wakefield who died last year.

This collection consists largely of letters, engravings, drawings and books relating to the civil engineering side of railway development from 1820 to 1850. Throughout his lifetime Mr. Briggs always contended that too much attention was given to the locomotive in the consideration of early railway history. As the son of a railway contractor whose work had brought him into close contact with famous civil engineers of the 19th century he determined to do his best to level matters up. He spared no pains in getting his collection together and took an immense pride in it.

In the course of his research work Mr. Briggs occasionally visited the Railway Museum, York, and it is the indirect outcome of these visits that the collection went to York on his death, although the final decision lay with his daughter.

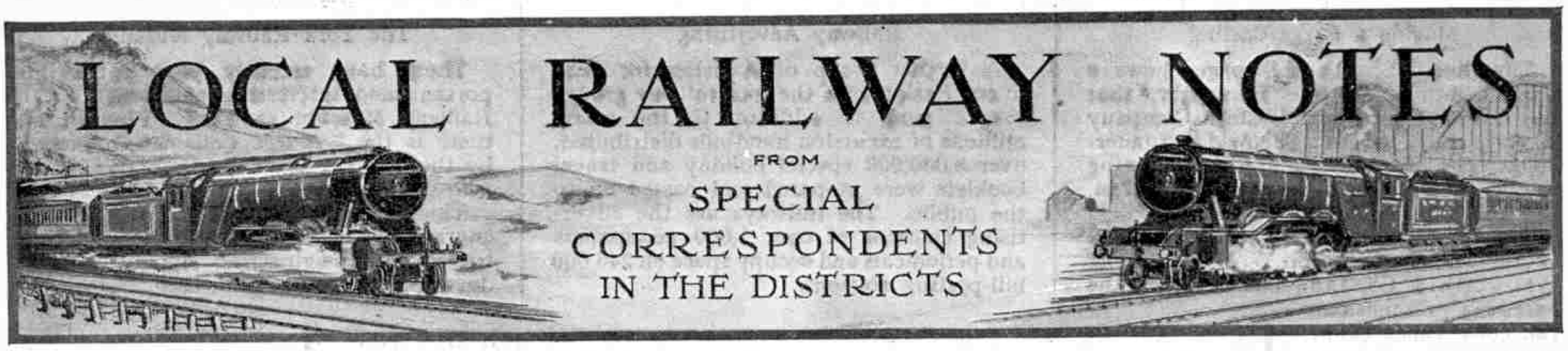
Letters written by famous railway pioneers form an important section of the collection and those of George Stephenson attract special attention. These letters depend upon more than the name of their distinguished writer for interest; they are colourful and characteristic. Here is an extract from one:—

"It will be well if you can go with them over the North British line. They will not pay you, but perhaps they *may* feed you."

The framed pictures and prints cover four walls and include not only authentic drawings and engravings of historic value, but also fanciful coloured lithographs—cartoons, etc.—some of which are quite amusing.

Another addition to the Museum secured through the agency of Mr. S. L. Murgatroyd, Permanent Way Engineer for the Southern Area, is an actual specimen of a piece of the tram road laid by Outram himself in 1797 to convey stone to the Peak Forest Canal, now the property of the L.N.E.R.

The cast iron plate rails are 3 ft. in length and weigh 56 lbs. to the yard. They are laid on stone blocks, on each side of which is a cast iron bed-plate with one hole through it. The rails have a notch cut out at each end, a boss being formed on the underside of the bed-plate, while a corresponding hole made in the stone receives this to prevent movement. The stone is drilled, a wooden plug put in and a spike with a countersunk head is driven through the holes at the junction of two plates through the bed-plate. This is a most interesting relic of early transport.



L.N.E.R. NOTES FROM LONDON

Latest "Foreigners" working on the G.E. section are 0–6–0's 917, 2345, 2360, 5318.

Several "Claud Hamilton" class 4–4–0's have been rebuilt to conform with the "Super Claud" class, some having extended smokeboxes. The "Super-Claud" class now includes 8780–8789, 8813, 8818, 8827, 8843, 8846, 8847, 8851, 8853, 8856; those having extended smokeboxes are 8813, 8827, 8843, 8851, 8856. "Claud Hamilton" class 8790, 8803 and 8819 also have extended smokeboxes. Engines of this class not yet superheated include 8795, 8802, 8804, 8806, 8828, 8829, 8833, 8834, 8836, 8865, 8868, 8875 and 8876. No. 8892 of this class, by the way, has a small tender. 8898 has "Ross-Pop" safety-valves. 8791 and 8794 have been fitted with top-feed to the boiler.

G.N. section 2–6–0's 4652 and 4664 have been fitted with the Westinghouse brake, and have been seen working local turns on the G.E. section. 4638 is working with its original type of funnel.

"Pacifics" 2569 "*Gladiateur*" and 2575 "*Galopin*" from the N.E. area have been working into London in connection with the non-stop London-Newcastle runs.

It is surmised that the next twenty 0–6–2T's of the N.2. class that visit Doncaster Works will be transferred to Glasgow and replaced by improved N.7's, 2462-2661, all of which are now at work, not fitted with Westinghouse brake, on the G.N. section. The type is stated to be unpopular with the drivers, but nine new ones, Nos. 2600-2608, are being built.

0–6–0 S.T.'s 4046–7 have been fitted with "Ross-Pop" safety-valves, and 3139A has a much shorter funnel than others of its class, giving it a more presentable appearance. 4–6–0 5475 was recently in King's Cross for minor repairs after working an excursion from Cleethorpes. It returned later hauling a goods train. 2–4–0 7461 was observed recently running light on the old M.S.W. line at Neasden. 7436 has worked some horse-boxes into King's Cross.

The L.N.E.R. have purchased several locomotives of the G.C. 2–8–0 type, numbered from 6543 onwards. 6599, 6619 and 6638 have been seen working.

New engines at present building include, besides the N.7's already mentioned, 10 new Pacifics to work in the West Riding and Scottish areas, and some improved "Director" 4–4–0's, class D.49, of which some are to be compounds. One experimental locomotive of the last named type has been completed. A new class of tank engine, in design following closely that of the "4630" class of 2–6–0's, is proposed for express work from London to Cambridge. Also, it is reported that several new "Director" engines are in hand, but confirmation is not yet forthcoming.

S. L. (London, N.18).

BIRMINGHAM

G.W.R. Most of the Worcester and Hereford expresses are worked by locomotives of the Flower and Bulldog 4–4–0 type. 3308 "*Falmouth*" (Stourbridge) was noted recently on the 11.40 a.m. to Hereford. Other locomotives which have been noted on these duties are: 3313 "*Jupiter*" (Worcester), 3409 "*Queensland*," 3412 "*John G. Griffiths*" (Worcester), 3418 "*Sir Arthur Yorke*" (Worcester), 4105 "*Earl Cawdor*" (Hereford), 4115 (Stourbridge), 4143 "*Cape Town*" (Tyseley), and "*St. Johns*" (Tyseley).

The Birmingham suburban trains are hauled chiefly by the large and small type 2–6–2T. All these are shedded at Tyseley: 3161, 3167, 3170, 3179, 4517, 4532, 4543, 4555, 4556, 4558, 4559, 4561, 4562 and 4580. Other engines which haul semi-fast and slow suburban are 4100 "*Badminton*," 4120 "*Athara*," 4126 "*Kimberley*" and 4168 "*Stephanotis*." These are 4–4–0 Flower Type.

L.M.S.R. The afternoon express to the Eastern counties was recently hauled by 4–6–0 mixed traffic No. 8856 (from Rugby Shed).

The following suburban tanks work on the Midland section: 1226, 1247, 1253, 1324, 1326-1328 and 1386 from Saltley Shed.

The following sheds are included under Birmingham Shed 3: Saltley, Redditch and Bournville. The Walsall shed (Pleck) is closed. There are no compounds shedded at Birmingham.

The majority of expresses are hauled by 4–4–0 class 2 engines: 430, 435, 437, 438, 439, 497, 507-508, 510-516.

J. W. L. (Small Heath).

ABERDEEN

The L.M.S. Royal Train in which the King came north recently was hauled by two Class 4 Midland 4–6–0's, Nos. 921 and 922, and when returning empty it was pulled by a Class 4 Midland 4–4–0, No. 1144 and a Caledonian Dunalastair 4–4–0, No. 14479.

Among engines observed are:—L.M.S. Class 4 Midland type 4–4–0, No. 9231, Caledonian 4–4–0 Dunalastairs, Nos. 14440, 14441, 14442, 14445, 14449, 14450, 14453, 14458, 14459, 14467, 14468, 14485, 14486, 14489, 14490, 14496, 14501, 14503, 14504. Caledonian Cardeans 4–6–0, Nos. 14612, 14755, 17909, 17910, 17911; a Caledonian 0–6–0, No. 17593, with tender No. 17588.

L.N.E.R. N.B. Atlantics, Nos. 9059 "*Duke of Rothesay*," 9902 "*Highland Chief*," 9872 "*Auld Reekie*," 9870 "*Bon-Accord*," 9868 "*Aberdonian*," N.B. 4–4–0, Nos. 9899 "*Jeanie Deans*," 9420 "*The Abbot*," 9340 "*Lady of Avenel*," 9427 "*Lord Glenvarloch*," Great North of Scotland 4–4–0, Nos. 6850 "*Hatton Castle*," 6854 "*Southesk*." Great Central Consolidation Nos. 6286, 6352, 6370.

J. G. F.

Recent L.M.S. Renumbers

New No.	Old No.		
5924	1345	"*James Bishop*"	Claughton
5688	2340	"*Tara*"	Prince of Wales
5648	2396	"*Queen of the Belgians*" (S)	"
5620	2198	"*John Ruskin*"	"
5514	1406	"*George Findlay*"	Experiment
5490	2112	"*Victoria*"	"
5483	2052	"*Stephenson*"	"
5453	372	"*Belgic*"	"
5406	2153	"*Llandrindod*"	George the Fifth
5341	1489	"*Wolfhound*"	"
5331	2271	"*J. P. Bickersteth*"	"
5323	1583	"*Henry Ward*"	"
5319	990	"*Bucephalus*"	Precursor
5299	1137	"*Vesuvius*" (S)	"
5265	1297	"*Phalaris*"	"

J.W.L.

GLASGOW

L.N.E.R. The 1 o'clock Glasgow-Edinburgh has recently been handled by that great worker 9428 "*Adam Woodcock*," the train invariably loading to over 300 tons. This engine also handled the Lothian Coast express most of last summer, doing the run regularly under the hour. Scott 9424 "*Lady Rowena*" is also taking Director's turns on the Glasgow road, and on a recent Sunday handled a theatrical special (8 corridor coaches and vans) conveying members of the British National Opera Company from Glasgow–Edinburgh.

The 5.11 slow Glasgow–Edinburgh (Director turn) recently had 0–6–0 9103 (6382 failed). On a recent Saturday Atlantic 9871 "*Thane of Fife*" (Dundee) worked the 3.51 hour run to Edinburgh. 9411 "*Dominie Sampson*" has been noted several times on the 6.29 express ex Edinburgh.

On a recent Sunday, five double-headed excursion trains left Queen Street Station. 9497 "*Peter Poundtext*" and 9307 "*Glen Nevis*" for Aberdeen, 6398 "*Laird of Balmawhapple*" and 9493 "*Glen Luss*" for Aberdeen; Directors 6397 "*The Lady of the Lake*" and 6380 "*Evan Dhu*" for Whitley Bay. "*Glen Beasdale*" and "*Glen Fruin*" for Crail and "*Glen Mamie*" and "*Glen Sloy*" for Fort William.

Up to the end of September, 18 Sunday trips had been made to Fort William, 9408 "*Glen Sloy*" heading the list with 10 trips. "*Glen Luss*" had made six trips and "*Glen Orchy*" five.

L.M.S.R. In connection with heavy trains out of Buchanan Street, bankers were recently used. 4–4–0 14474 was banked by 4–6–0 17901, and 4–4–0 14481 had 0–6–0 17554. Another banker was 17557. These were provided with slip couplings operated from the cab by ropes.

4–6–0 14650 (old 60) left unbanked on a heavy train. In connection with holiday crowds from Edinburgh, the 7.5 express Edinburgh–Glasgow left Edinburgh with 4–4–0 14444 (Carstairs) and 920 one Saturday.

J. M. C. (Glasgow).

MANCHESTER

Midland type 4–4–0 compounds may now be seen at each of the four main stations in Manchester. Many of the fast "business" trains to and from Southport and Blackpool (leaving Victoria) and also London expresses from both London Road and Central Stations are hauled by this class. At London Road, tank engines of the North Staffordshire line are much in evidence, working local services and expresses to Stoke and Stafford. They are also much used for station shunting. Heavy expresses for Buxton are shared by Horwich-built 4–6–4 tank locos, Crewe-built 4–6–2 tanks, and mixed traffic tender locos.

A light express brought in to time by old Precedent 934 "*North Star*" was a reminder of former days; other engines of this rapidly dwindling family to be seen working round Manchester are "*Adelaide*" (station pilot at Exchange) and "*General*."

An unusual arrival at London Road was an express from Hull (L.N.E.R.) consisting of only two carriages and drawn by a Great Central 4-cylinder express loco running tender first.

Great Eastern 4–6–0's and new (North Eastern type) "J39" 0–6–0's also work into Manchester. The oldest locos seen recently were a Crewe-built "DX" goods engine, and an old 0–6–0 saddle tank shunter, both engaged in passenger work.

Great Western passenger engines working to and from Exchange Station are of the 4–4–0 small-wheeled type, but they get away smartly with loads up to 15 carriages. One of this class recently hauled the Irish Mail for Holyhead, with an L.M.S. "George V" 4–4–0 as pilot. Expresses for the Leeds and Yorkshire line are almost invariably taken by "Prince" class 4–6–0's.

On an afternoon recently, L.M.S. locomotives numbered 1111 and 11111 were standing at adjacent platforms in London Road Station. The former is a standard 4–4–0 compound and the latter one of the large Lancashire and Yorkshire type 4–6–4 tank engines which do good work on the heavy residential expresses working to Buxton. Both are stationed at Longsight, which is the London Road depot for Manchester. Another curiosity was a class "G" eight-coupled mineral locomotive leaving on a local express: one would like to know what speed these somewhat clumsy-looking engines can attain.

Certain express engines of the well-known "George V" class have been newly painted in the L.M.S. passenger livery, and permanently coupled to Great Central pattern tenders formerly belonging to some of the Ministry of Munitions 2–8–0's which have been broken up at Crewe. The result is neater than one would expect. "*India*," "*Australia*," and 4–6–0's "*Gallipoli*," and "*Raymond Poincaré*" are among locomotives thus fitted.

A large number of North Stafford engines, both passenger and tank, now work to and from London Road, and nearly all local trains on the Altrincham service are hauled by 0–6–2 tanks from Stoke Works, painted black.

The heavy L.M.S. suburban traffic is mostly attended to by "Precursor" tanks which formerly operated in the London district. There are also one or two auto trains of four carriages propelled by a Webb 0–6–2 tank working in the centre. The "Mancunian" express, which is a very popular train, is generally worked by a special "Claughton," one fitted with Caprotti valve gear having been noted on this service.

The new "Royal Scot" class do not work into Manchester as yet, but one of them was recently exhibited at a Railwaymen's festival at Belle Vue.

On the day that it so narrowly escaped disaster on a viaduct near Aberdeen, the "Royal Highlander" express was brought into Crewe very late by an original "Experiment" class engine "*Britomart*."

On the L.N.E.R., Sunday excursions to and from London have been hauled by Great Northern Atlantics, which, apart from one or two working into the Central Station over the Cheshire Lines, are very occasional visitors to Manchester.

R. S. M. (Manchester).

* * * *

Two old G.E.R. 0–6–0 Tanks, Nos. 7342 and 7392, recently appeared at Cowlairs and have since been seen under steam at Eastfield. These have straight chimneys with no beading at the top. A new breakdown crane also has arrived at Eastfield. The name "Loco Department, York" originally was painted on it but this has since been changed to "Eastfield."

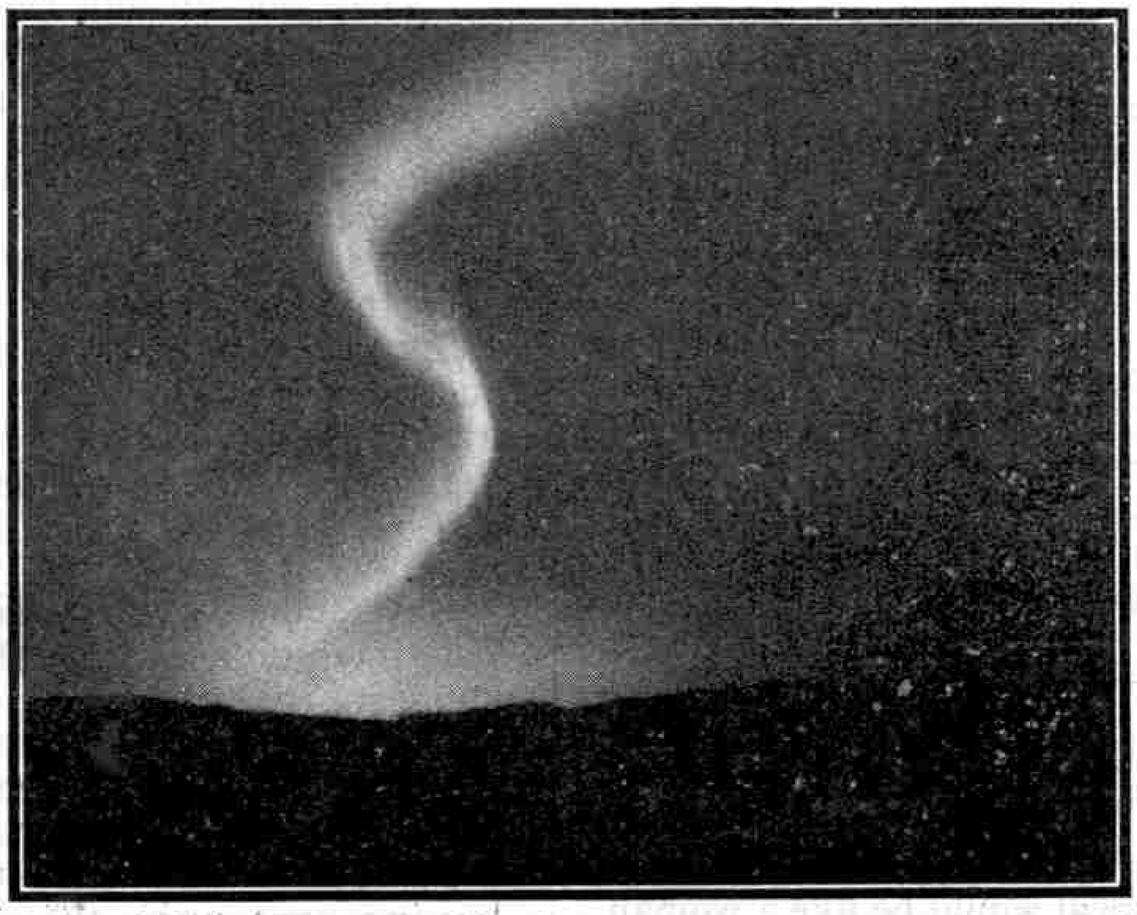
Filming the Aurora Borealis

The Wonder of the Arctic Night

By Harold J. Shepstone, F.R.G.S.

ONE of the most beautiful sights in Nature is the Aurora Borealis, and these wonderful fairy lights of the Arctic recently have been filmed for the first time. A valuable series of photographs has been secured, as well as much important scientific data obtained concerning them.

We who reside in more temperate latitudes can scarcely appreciate what these lights mean to those who dwell in the Far North. Within the Arctic Circle—and that includes Lapland, Iceland, Greenland, Alaska and the northern portions of Russia and Canada—there is no sun for six months of the year. The great luminary, upon which we depend for light and heat, disappears in October, only to reappear in the following March. Although from October right on to March is virtually one long night, it is far from being all darkness, for the sun sends radiant messengers from below the horizon far up into the skies above it, where the air is very thin, or rarefied. These electrical messengers or "electrons," which cause the atmosphere to glow and gleam in all varieties of colour, are the cause of the wonderful Aurora Borealis, one of the most inspiring sights on earth. Without its light many thousands of people who live in the Far North would be unable to travel about, visit friends, or do any work.



A wonderful photograph of the Aurora Borealis, the cathodic rays of which are analogous to radium rays

A famous Norwegian scientist, Professor Carl Stoermer, has now filmed these lights, and in recognition of the feat the French Academy of Science has awarded him the Jansen medal. Professor Stoermer spent twenty years in his strange quest. It entailed many expeditions into the Arctic where he had to remain for the greater part of the long winter, ever on the watch for the elusive lights. He has had to devise special sensitive photographic plates, delicate timing devices, and costly apparatus to enable him to catch and record the movements of these wonderful and beautiful bands of coloured lights.

Lapland was the place selected, and at Bossekop, and also at Store Korsnes, some 15 miles distant, observation stations were established. Furthermore, they were placed in telephonic communication with one another, so that one station could check the work of the other. Thus the observers at both stations were enabled to take a photograph of the same light simultaneously, plates being exposed on the same phenomena at both places for exactly the same length of time. By means of such photographs it was possible to determine the form, altitude, and position in space of the Aurora Borealis while the cinema recorded its rapid transformation.

Often the Aurora appears as a great arch, with flickering curtains of many-coloured lights hanging like shining gossamer in the sky, with ever-changing form and colour, while shafts of light shoot from the top of the arch far up into the sky. Sometimes there is no distinct arch, but moving curtains of light appear in many forms, which dance and shimmer and change with such variety and beauty that it is a delight to watch them. These coloured lights play on the white snow, tinting it with beautiful hues until the whole scene is like fairyland.

Another photograph of the Aurora, the height of which is only 60 or 70 miles above the earth

The colours are almost beyond description. "The rays," says Professor Stoermer, "would sparkle with the purest, most crystalline rainbow colours, chiefly violet, red or carmine, and the clearest green. Most frequently the rays of the arch were red at the ends, and changed higher up into sparkling green, which quite at the top turned darker, and went over into blue or violet before disappearing in the blue of the sky; or the rays in one and the same arch might change from clear red to clear green, coming and going

(Continued on page 1105)

SOME XMAS SEA PRANKS

BY

MANNIN CRANE

AUTHOR OF "YARNS OF A WINDJAMMER"

"IN the midst of life we are at sea" was the remark of an old shipmate of mine on one occasion. There was a wealth of meaning in the tone of his remark for it was Christmas time. No doubt ocean travellers enjoy the novelty of Christmas at sea in a liner, but I wonder if they ever speculate what a novelty it would be for a sailorman to enjoy Christmas by his own fireside. To a sailorman, in the passing of years, Christmas becomes a commonplace affair in the calendar. Looking back, he may see the humour of it all, which was not apparent at the time. Read for yourselves and see.

Christmas is more or less an excuse for feasting. Yuletide without the heavy meal would be like a woman without curiosity, both of which are legends similar to Mrs. Wiggs. Especially does this feasting appeal to the younger people, and bitter was the disappointment among four healthy growing boys in the half-deck of a certain sailing ship in my very early days at sea, for the captain, who was also the owner, had decreed that there was to be no Christmas dinner. He was a man of business and he was gracious enough to explain why. Here are some of his reasons: (1) We were in port in Australia and it was summer weather. The old-fashioned dinner would be out of place; (2) the Missions to Seamen had a magnificent programme, including a Christmas dinner; (3) after seven weeks in port we should have found some friends.

To be blunt, all three reasons were good ones, but, not so, in the opinion of the boys. In their bitterness of disappointment they brewed a scheme of revenge. It was drawn up in secrecy.

Instructions had been left that on Christmas morning the boys were to hoist up a brand new ensign on the peak halliards. Crowds of people admired the smart looking, green painted clipper ship the whole of the morning, and the Captain's Christmas dinner went off with a swing.

According to police records, the captain, with his wife and the mate, came up on the poop for the first time that day, about three-thirty in the afternoon, and they were astonished at the large crowds on shore, admiring the ship.

Noticing that eyes were mainly directed up aloft, the mate glanced overhead at the peak and there, one hundred feet high, for the whole harbour to see, was a huge skull and cross bones! There was a frantic rush to the halliards to haul down the grotesque signal, but the halliards were fast aloft.

Whistles blew for the boys, but no boys came. Truth to tell, the crew were hidden in the bushes barely a hundred yards away, almost tired of waiting for this glorious moment.

The captain and the mate, each taking a side of the rigging, sprang aloft, perhaps for the first time for a dozen years, and after five minutes puffing and blowing the offending "message" crashed to the poop close to the captain's agitated wife. The din and racket was awful, for the skull was a huge twenty-inch kettle, crudely painted, and the cross bones were once the thigh bones of a horse.

Six months pin-pricking punishment for four boys and some of the crew, did not rob us of the joy of those frantic endeavours on the part of the old man and the mate, and the ironical cheers of the onlookers.

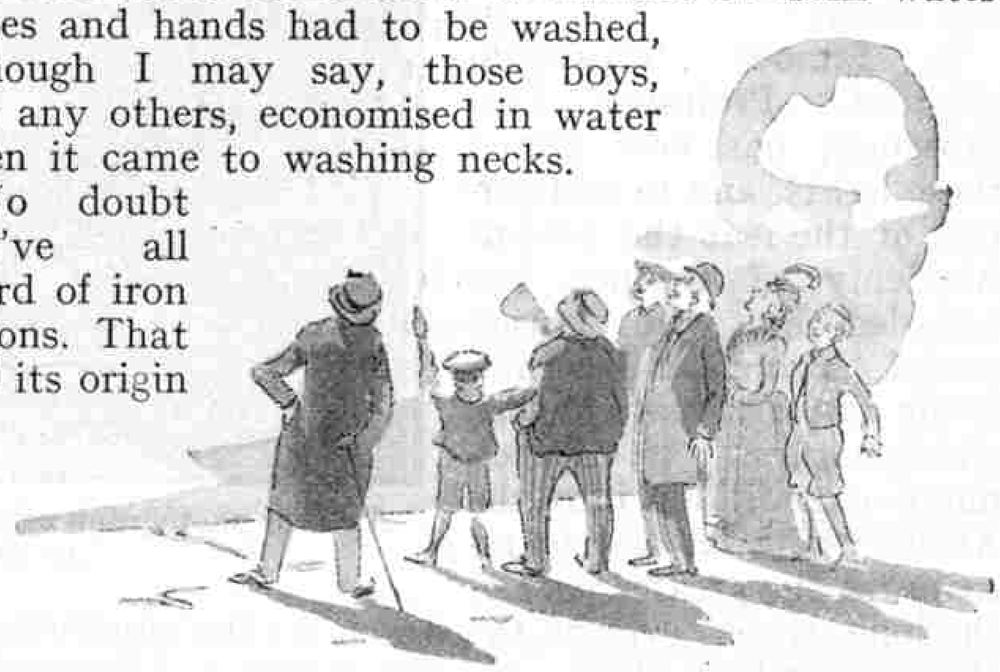
* * * *

How some boys contrived to get a bird for their Christmas dinner is worth recounting, although it did not happen on the ship referred to above. Several months had gone by since leaving port, so that there was very little left in the way of fancy or tasty food. What was left was reserved for the captain.

But there was a hen-coop, and those boys cast many longing eyes upon the cackling inmates. Obviously, the wish was father to the thought. "If only we could have a bird for Christmas?" The prospects were not very bright. The hen-coop was padlocked, and it was near the officers' quarters, besides which, hens make an unearthly row when they are disturbed. The menu for dinner, however, was enough to put a steel wire backbone into a worm. Here is the official list of food for the whole day, so that anyone who wanted to enjoy his dinner at breakfast time could do so, but there would be little or nothing left for the rest of the day.

Four quarts of water for each person is given out once a day. That seems quite a lot I know, but don't forget that the cook takes most of it for cooking purposes. Tea and coffee comes from the rations of fresh water. Faces and hands had to be washed, although I may say, those boys, like any others, economised in water when it came to washing necks.

No doubt you've all heard of iron rations. That had its origin



"Large crowds on shore admiring the ship"

in sea biscuits. Biscuit makers were nearly a century ahead of steel makers. The well known Liverpool pantiles have successfully withstood the attack of a fourteen pound sledge hammer, and, like a parrot, the biscuit has kept on repeating "Scratch me!" These biscuits on that far away Christmas time were about four inches in diameter and half an inch thick. Seven for each person was the daily allowance.

Salt beef is the next item. There was one and a quarter pounds of that, bones or not. Don't be misled. It is nothing like salted brisket. Butchers can cut brisket, but sea cooks cannot cut salt beef before it has been soaked for a day or so and cooked for many hours.

"They murdered that bird at three a.m. with a . . . thrust in the head"

Prosaic language cannot be used to describe sailor's salt beef. I'll try some technical jargon. Salt beef is a rubbery, coarse-grained, left-handed and pinion jointed substance, specially invented to harden sailors, and keep them fully occupied during meal times. It is used for making little models of ships, dandyfunk, and occasionally food. It will keep for ever if left undisturbed, but is always ready to defend itself when attacked.

There's half a pound of flour as an item. This is invariably handed over to the cook in the hope of getting it back as a piece of bread. Sometimes it is returned as duff, but more often as paper weights or missiles. All old-fashioned sailors dream—one hardly likes to say have nightmares—of the duffs they have had. Duff is simply steamed or boiled bread, but because it is the nearest approach to a suet pudding on board ship, it has become, in more senses than one, one of the foundations in our maritime history.

A sea-cook with the gift of imagination will use a little flour to make some dumplings, about the size of walnuts, in the pea soup, for the law allows one-third of a pint of split peas in the course of a week. But don't forget, however, that the total amount of flour is still eight ounces. Oatmeal also, forms part of the diet for this Christmas Day of which we are speaking. The quantity is four ounces, and, of course, it is used for porridge.

So now you have it. Water, salt beef, seven biscuits, some oatmeal, and the flour. Can you wonder that those boys cast eyes upon the poultry?

On that Christmas Eve there was a tragedy. A chicken died. No one knew how it died or why it died. Jock drew the steward's attention to the corpse on Christmas morning. That steward was somewhat worried, for he was responsible for the hencoop, and he, in fear and trepidation, told the captain all about it. The captain, the mate, the steward, and Jock gazed upon that chicken, but none of them were able to work miracles, so it remained dead.

"Well," said the captain, "as we don't know what it died from you'd better throw it overboard."

"Aye, aye, sir!" replied the steward. Just at that moment a heavy sea struck the ship and all scattered for safety. The steward was unlucky. He was washed about the deck in the rushing water. Truth to tell, he didn't know for the moment whether he was overboard or not, and Jock grabbed him, unceremoniously pulling him to safety.

The steward spluttered out his thanks to Jock, for Jock told him point blank that he had saved his life. As Jock helped him to his cabin, he added, "How about that dead hen, steward?" But the steward repeated the captain's instructions.

"That's all right, steward, you won't have to eat it!"

The bird was theirs!

During all this time four pairs of eyes had closely watched these proceedings from the half-deck door, and there were four sighs of deep relief as Jock vigorously scratched his head with both hands, which was the agreed signal. In fact, Jock was so jubilant at his success, that he would have cheerfully scratched his head with both feet for a sign if necessary.

Ginger, the remaining boy, was at the wheel in a fever of suspense. He could not see what had happened, but he *did* see Jock running for'ard without touching the lifelines, so necessary in bad weather, a sure proof that he carried a precious burden, and for the fifth time the ship was well off her course as Ginger's imagination ran riot over the question of legs, wings, and a slice of the breast.

Perhaps I'd better tell you what was the cause of that bird's death. Under the shadow of night, not to speak of the shadow of terrible punishment, Ginger and Poppy had fastened a strong sail-maker's needle to the end of a broom handle, and they murdered that bird at three a.m. with a dexterous and cunning thrust in the head.

* * * *

We have to thank the Cunard Steamship Co. for permission to print this interesting story.

Adventures in Meccanoland

Every Meccano boy who has read the story of "Dick's Visit to Meccanoland" will be interested to know that we have now published a new booklet telling of Dick's further adventures in this wonderful country.

The booklet is profusely illustrated with humorous sketches, and Meccano boys will find great enjoyment in building up and operating the many different models that are the principle feature of the illustrations.

The price of the book is 2d. post free. All applications should be accompanied by stamps for this amount and addressed to Meccano Ltd., "Adventures," Binns Road, Liverpool.

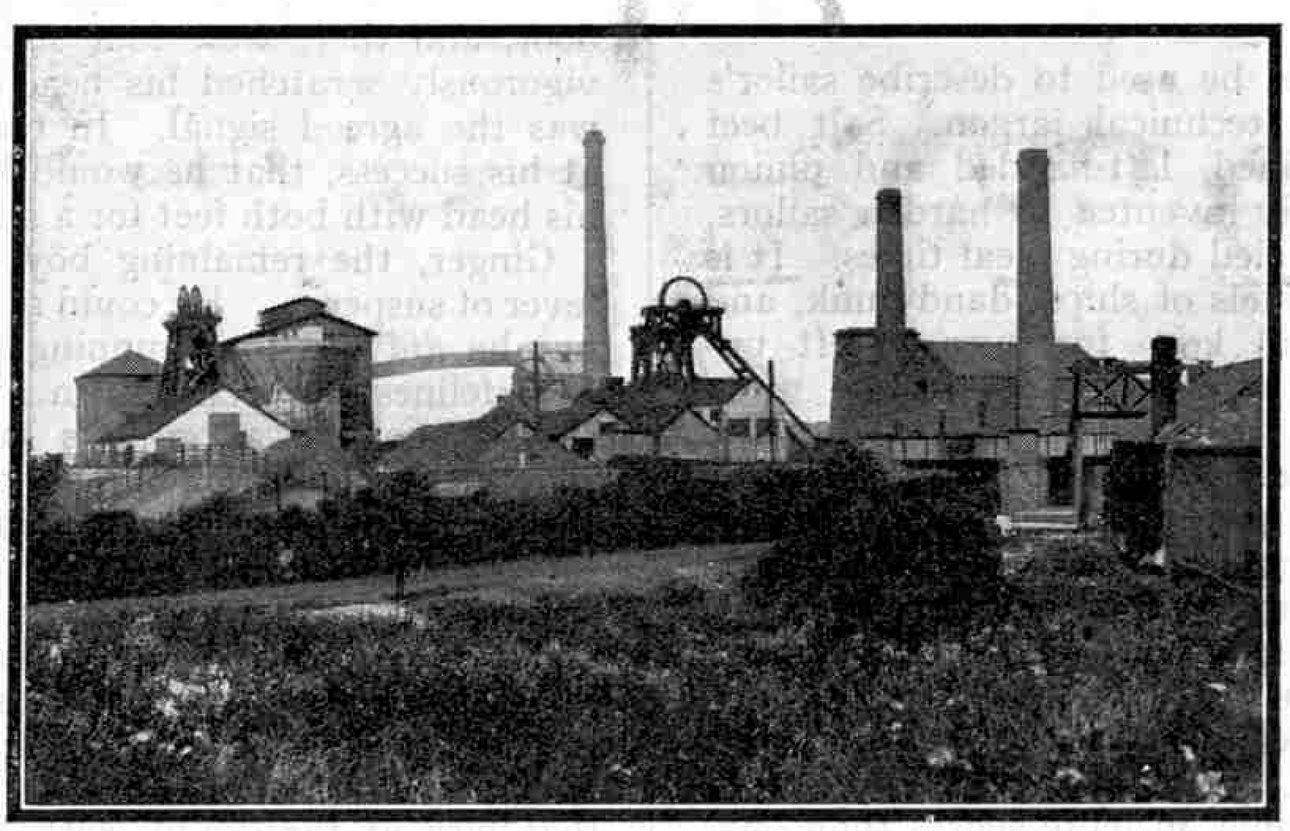
FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for this page are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Down a Coal Mine

A little while ago I was fortunate enough to have an opportunity of paying a visit to a coal mine.

Putting on old clothes for the occasion, we set off on our tour of inspection. After a brief examination of the machinery on the surface we went towards the cage, but before entering it we had to turn out all matches from our pockets and obtain lamps. We then entered the cage along with a number of miners. The cage was double-decked and lines were spiked to the floor. We descended very quickly and about half-way down it seemed to me as though we were going back upagain, and the miners said that they too, had this feeling. On arriving at the bottom we stepped out, tubs full of coal were pushed in, and away went the cage, cutting off communication with the world above.



Wombwell Main Colliery

The pit bottom was like a great square brilliantly lighted by electric light. It was well timbered with pit props, as were also the roads or tunnels leading off to the workings. We followed our guide through a door to the stables, which were whitewashed and lighted by electricity. There were only a few ponies in at the time. We were then led down a wide timbered tunnel. After a short distance the electric lighting ceased and the timbering ended. The tunnel now got smaller. At first there was an occasional pit lamp hung on hooks in the pit props, but soon even these ended. This did not matter, however, because we were well provided with lamps.

In the distance we heard the sound of pick and shovel and in a little clearing we came upon six miners hard at work, their skins black with coaldust through which trickles of perspiration had washed a way. Three of the men were on their backs hacking at a slab of coal above them weighing several tons and supported by short pit props. Our guide told us that this slab of coal would be shot fired next day. Yards of used shot-firing wire were on the ground and tied round pit props. The air was very warm and thick with coaldust.

After a stay of about a quarter of an hour we went back and found the cage already down, and this time we had the feeling of going down when we were really going up. It was a pleasant change to be once more in the open air after the stuffy blackness of the pit.

W. J. WORSFOLD (Wombwell).

A Visit to a Bobbin Factory

A short time ago I had the good fortune to accompany a party on a visit to the bobbin works of Messrs. Wilson Bros. at Garston, Liverpool.

When we arrived we were first taken to the seasoning yard where the wood is stacked up in open sheds, just as it comes from Ireland in one of the three steamers maintained by the company for the purpose. This timber is landed at the Garston Docks, which closely adjoin the works and to which they are connected by sidings. At the time of our visit the firm had from 4,000 to 4,500 tons of timber in stock, a supply sufficient for about seven weeks.

We then passed into a room where the wood is sawn into lengths suitable for making bobbins. The pieces that have knots in them are discarded while the good wood is taken to the next room where it is "bored and roughed." This means that it is roughly shaped and a hole is bored through the middle in these preliminary operations.

After the bobbins have been through this process they are taken to the drying-room where all the moisture is extracted from them by placing them over hot-water pipes. They are then sandpapered and fitted with metal rings to strengthen them.

To render the bobbins impervious to water or oil they are dipped into vats of waterproof enamel and put into ovens. These ovens bake the enamel on to the bobbins, thus making them quite waterproof.

We were then taken to the testing department where the bobbins are tested for accuracy. They are mounted on a spindle similar to the one on which they will eventually be used in the looms. After passing this test they are ready for packing into the wooden boxes in which they are despatched to purchasers.

The principal motive power is steam, which is supplied by four Lancashire boilers fired mostly by waste wood. There is also an additional power house containing gas generators, gas engines, dynamos and switchboards, which supply power for numerous electric motors throughout the works. A most interesting process turns all waste wood and sawdust to useful purposes. This takes place in the chemical department where it is heated in retorts and the vapours given off are condensed.

The residue in the retorts is charcoal, and pyroligneous

acid is obtained in the condenser. This latter is subjected to further treatment when it yields various valuable chemicals, including acetic acid and vegetable naptha.

As a guard against fire the premises are fitted with automatic sprinklers. In addition the company have an independent fire pump capable of throwing 30,000 gallons of water and also a private fire brigade the members of which are drawn from the employees of the firm. The automatic fire sprinklers are brought into play by any extraordinary rise in temperature, the perforations in the water pipes in various positions being closed by materials that melt in these circumstances.

The bobbins made at Garston are not the ordinary small ones used for winding sewing cotton. They are much larger and are intended for use in the great spinning mills of the north of England. Their purpose is to receive the yarn at various stages of the process by which raw cotton or wool is transformed into material suitable for weaving cloth. W. E. Booth (Wallasey).

Las Palmas, Grand Canary

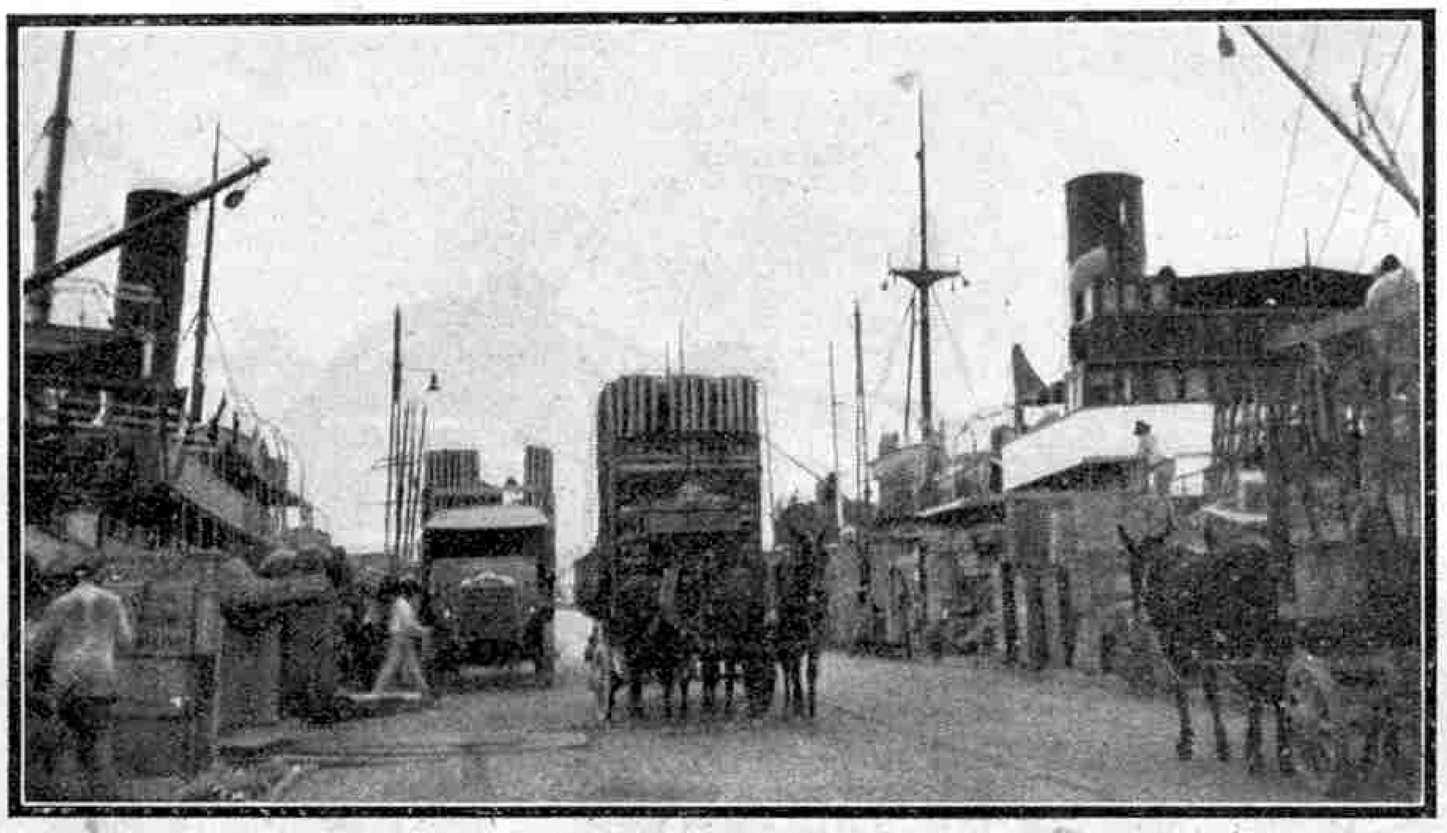
Probably many "*M.M.*" readers will be interested in a short description of Las Palmas, which is a fair-sized town scattered along the shores of one of the largest islands of the Canary group lying off the west coast of Africa. The port is situated in a large natural harbour behind which is another bay that is very popular for bathing. The town itself is about a mile down the coast.

The most interesting and incidentally the cleanest part of Las Palmas is the "muelle" or mole. This forms one bar of the harbour and outside is the roadstead, which is always occupied by two or three vessels of medium size. Inside there is a maze of steamers, coal lighters and sailing vessels, while in the distance are the huge Shell oil fuel tanks. I saw the "*Monte Sarmiento*," a huge motor ship, start off one day and it made a noise like a giant steam roller!

The accompanying photograph gives a good idea of the mole. On the left can be seen a Yeoward liner from Liverpool and on the right is a Norwegian ship. The horse wagon in the centre is stacked high with banana crates. I used to spend many hours down here. The scene is always very animated with wagons and motors streaming along and at least half-a-dozen boats alongside.

The first thing that strikes you about the town itself is the peculiar sweetish odour arising from the smoking of unlimited numbers of Havana cigars and cigarettes. The buses—which are Fords or Chevrolets, with a Morris here and there—are very picturesque. Two rows of seats are provided, with a canopy as the only protection. The driver usually conducts when he is not driving at a furious rate; there is no speed limit. It is wonderful how any vehicle stands the main road, which is a mass of pot-holes, and the conditions are made worse by constant watering. The girls are very beautiful and never wear hats, a great contrast to the men who wear dark clothes and straw hats. On Sunday everyone turns out to see the football match; the Spaniards are absolutely mad on the game.

The general beauty of the country is spoiled by the entire absence of grass, but in the interior there are some fertile valleys with trees and plantations of the little banana trees. The roads are very fine here, zig-zagging up the mountain sides with perilous hairpin bends and unprotected drops of hundreds of feet. The highways are well bordered with trees and in some places there are hedges of geranium and cactus. I have seen a geranium bush, some 10 ft. in height, literally a mass of flowers. Water is very scarce and it is collected in reservoirs in the hills during the only month when it rains. A. D. Smalley (London, W.2).



The Mole, Las Palmas

A Water Fire-Tower

A short time ago I paid a visit to a local fire-station and among the many interesting things I saw there the one that appealed to me most was the water fire-tower. This is a motor chassis with a telescoped ladder mounted upon it and it looks very like some very new type of fire-escape.

When an alarm of fire is given the fire-tower with its crew of three proceeds immediately to the scene of the outbreak, being the last of the line of fire-fighters. On arrival the captain of the crew gives an order and the ladder is opened out by turning a small handle on the side of the circular base on which it stands. The ladder is not rested against the burning building, but goes up 80 ft. into the air, and the whole contrivance stands in the middle of the road.

On the ladder being opened a feature that escapes our attention while it is telescoped is revealed. This is a hose that runs the whole length of the ladder, and it has a nozzle at the top that may be pointed in any direction by one of the firemen who climbs to the top of the ladder where a copper platform is provided for him. A second fireman joins the hose to the pumping engine and water is forced up the hose at a pressure of 80 lb. per sq. inch.

In the meantime the captain of the crew, by turning a large handle, has swung the ladder round to the required position. The second man now takes charge of the handle and the captain then devotes his attention to giving instructions through a megaphone to the fireman at the top of the ladder in regard to the direction of the jet.

It is often possible with the aid of a fire-tower to pour an effective flood of water on a fire that otherwise would be difficult to reach.

E. T. Bryant (London).

FAMOUS TRAINS XII.

The "*Royal Scot*," L.M.S.

By Cecil J. Allen, M.Inst. T., etc.

Photo courtesy] ["*The Times*"

The "*Royal Scot*" passing Leighton Buzzard

IN this country the year 1927 has been one of railway record-breaking. Three out of the four great railway groups have each produced an express passenger locomotive design of greater power than ever previously attempted on their respective lines, and it was only a year previously that the fourth of the groups did the same thing. A working steam pressure of 250 lb. per sq. in., higher than ever previously employed in a British locomotive design, has been incorporated in two of the 1927 designs just mentioned. While these developments have been taking place in the locomotive power itself, new changes of a record character have been made in the working of the train services for which these engines have been designed.

During the past year there has been a kind of "competition" in long-distance running. The world's record in daily non-stop journey distance, hitherto held for so many years past by the Great Western Railway with their 225¾-mile journey from Paddington to Plymouth, went doubly by the board last summer when the L.M.S. Company instituted non-stop running over the 236 miles between Euston and Carnforth, and the London and North Eastern over the even longer distance of 268½ miles from King's Cross to Newcastle-on-Tyne. From the end of September even that feat has been eclipsed, however, by a daily L.M.S. run over no less than 299¼ miles between Euston and the Border City of Carlisle.

It is the "*Royal Scot*" Express—the subject of our consideration this month—that is responsible for this remarkable feat, and it is the new "Royal Scot" type of three-cylinder 4–6–0 express locomotive, which is one of the two new British types employing the record working pressure of 250 lb. per sq. in., that has made possible the institution of such a working. As a daily proposition of non-stop running this is far and away a world's record. On three earlier occasions Webb compound engines had essayed the feat successfully—first the three-cylinder 2–2–2–0 compound "*Ionic*" in 1896, and then a run in both directions by two four cylinder compound 4–4–0 engines of the "Jubilee" type in 1902—but these were special trips for which special preparations had been made.

There are also regular locomotive workings in force in various parts of the world of 500 and more miles continuously, on which, however, intermediate stops are made for changing crews, examination of train and taking in supplies. But never before in the world's history has one locomotive and crew been faced with continuous running of nearly six hours' duration, with a heavy express, at an average speed of 52 miles per hour throughout. Indeed, it is probably correct to say that only in Great Britain is the maintenance of locomotives and rolling stock so carefully watched that unbroken running of this character is possible without risk. One's only mild regret is that it has not been found possible to change engines at Kingmoor sheds instead of Carlisle Station, as that slight alteration would have lifted the length of run just above the 300-mile mark.

It had been intended to introduce the "*Royal Scot*" in the summer of last year, but the coal dispute made imperative a postponement until last summer. The first idea was to cover the 230 miles from Euston to Lancaster without a stop, which would have been just sufficient to beat the Great Western Plymouth run, but when rumours began to circulate that the London and North Eastern contemplated a journey over the 232 miles between King's Cross and Darlington, the L.M.S.

Leading Dimensions of 3-cylinder 4-6-0 Express Locomotives, "Royal Scot" Class

Cylinders (3) Diameter	18 in.
Stroke	26 in.
Driving Wheels, Diameter ...	6 ft. 9 in.
Heating Surface, Tubes	1,892 sq. ft.
Firebox	189 ,,
Superheater ...	445 ,,
Total	2,526 ,,
Firegrate Area	31.2 ,,
Working Steam Pressure ...	250 lb. per sq. in.
Tractive Effort (at 85 per cent. working pressure)	33,150 lb.
Adhesion Weight	62½ tons
Total weight of Engine	85 ,,
Water Capacity of Tender	3,500 gals.
Coal ,, ,, ...	5½ tons
Weight of Engine and Tender (in working order)	127¾ tons
Length of Engine and tender overall	63 ft. 3 in.

"played" Carnforth instead. Carnforth, being a locomotive depot, was in some respects more suitable than Lancaster for engine-changing, and it also had the merit of bringing the long run from London to an end just before the beginning of the long climb up to Shap.

Throughout last summer this run was maintained, the train engines being a four-cylinder 4–6–0 "Claughton," and the pilot a 4–4–0 of either the "George the Fifth" or the closely corresponding superheated "Precursor" type. At Carnforth these were replaced by a couple of Midland three-cylinder compounds from the Polmadie shed in Glasgow, which covered the next stage of 130 miles between Carnforth and Symington, in Scotland, without stopping. There the Edinburgh portion was detached from, or attached to, the Glasgow portion of the train. Not only did the latter run involve the previously unheard-of passage of Carlisle without a stop—certain night trains in the summer had hitherto missed the Citadel Station, but had always been halted at either the North Western or Caledonian engine-sheds to change engines—but it also involved the Scottish engines in the negotiation in succession of the 915-ft. altitude of Shap and the 1,015-ft. altitude of Beattock Summit, with an intermediate drop practically to sea-level just north of Carlisle.

Photo] [*F. E. Mackay*

Up "*Royal Scot*" passing Kenton. Engines Nos. 5273 and 5989

During the summer, however, the Scottish compounds did splendidly with this train, gaining time almost invariably with a train whose minimum formation was 15 bogie coaches, not infrequently mounting to 16 and even 17 coaches. These Northern engine workings were "balanced" by certain altered night schedules in order that the compounds might not have to remain idle at Carnforth for over 24 hours. Thus the 10.30 p.m. out of Glasgow was worked over the 165½ miles from Glasgow to Carlisle nightly without stopping, and the 9.20 p.m. night express from Euston ran through from Carnforth to Carstairs, in both cases, of course, giving Carlisle the "go by."

Meanwhile, however, the L.N.E.R. had rather taken the wind out of the L.M.S. sails by instituting their run between King's Cross and Newcastle. In justice to the L.M.S. it must be remarked that the L.N.E.R. run was made on but four days a week and in one direction only. It was, moreover, at a lower average speed, and was withdrawn when the winter train service came into force at the end of September. At the same moment railway circles were electrified by the unheralded announcement of the L.M.S. Company that in future the "*Royal Scot*" would make no halt between London and Carlisle.

It may be taken as tolerably certain that this is the "last word" in the controversy. In order to beat the distance to Carlisle the Great Western would require to run non-stop over the 305 miles from Paddington to Penzance, for which journey, even if desirable, a sufficient daily passenger load could never be obtained to make the feat a paying proposition. Similarly the L.N.E.R. would need to run from King's Cross to Berwick. There are such formidable objections to any further extension of the distances covered without intermediate stop—chief among which are the strain on the crew, no less than on the machine, and the lack of any opportunity of examining the train—that, as I have said previously, the L.M.S. record is not in the least likely to be challenged.

With the institution of the non-stop journey to Carlisle the L.M.S. locomotive authorities have introduced the "Royal Scot" locomotives. Piloting has ceased at the same time, and while the working of a 15-coach express train over Shap Summit without assistance does not constitute a record, it is certain that never previously has such a tare weight as 417 tons been worked up the far steeper 10 miles of Beattock Bank without the help of a banker. The merit of the ascent of Shap from the Southern side—which is considerably steeper than the Northern—is further enhanced in that it has to be tackled by the engine after the latter has been in continuous running for 4½ hours, when the fire is getting dirty and clinker may be forming on the firegrate.

To institute such an innovation as this run at the beginning of the winter is, indeed, rather a daring stroke, seeing that, while the load has been reduced for winter working, the probability of bad weather with its adverse effect on the running has to be borne seriously in mind. Fog over the southern stages of the run, or gales sweeping over the exposed lengths of line along the shores of Morecambe Bay or up in the lofty altitudes of the Westmorland hills, may prove a serious problem to the crew on a mid-winter day. Whether this remarkable working continues permanently in force remains to be seen.

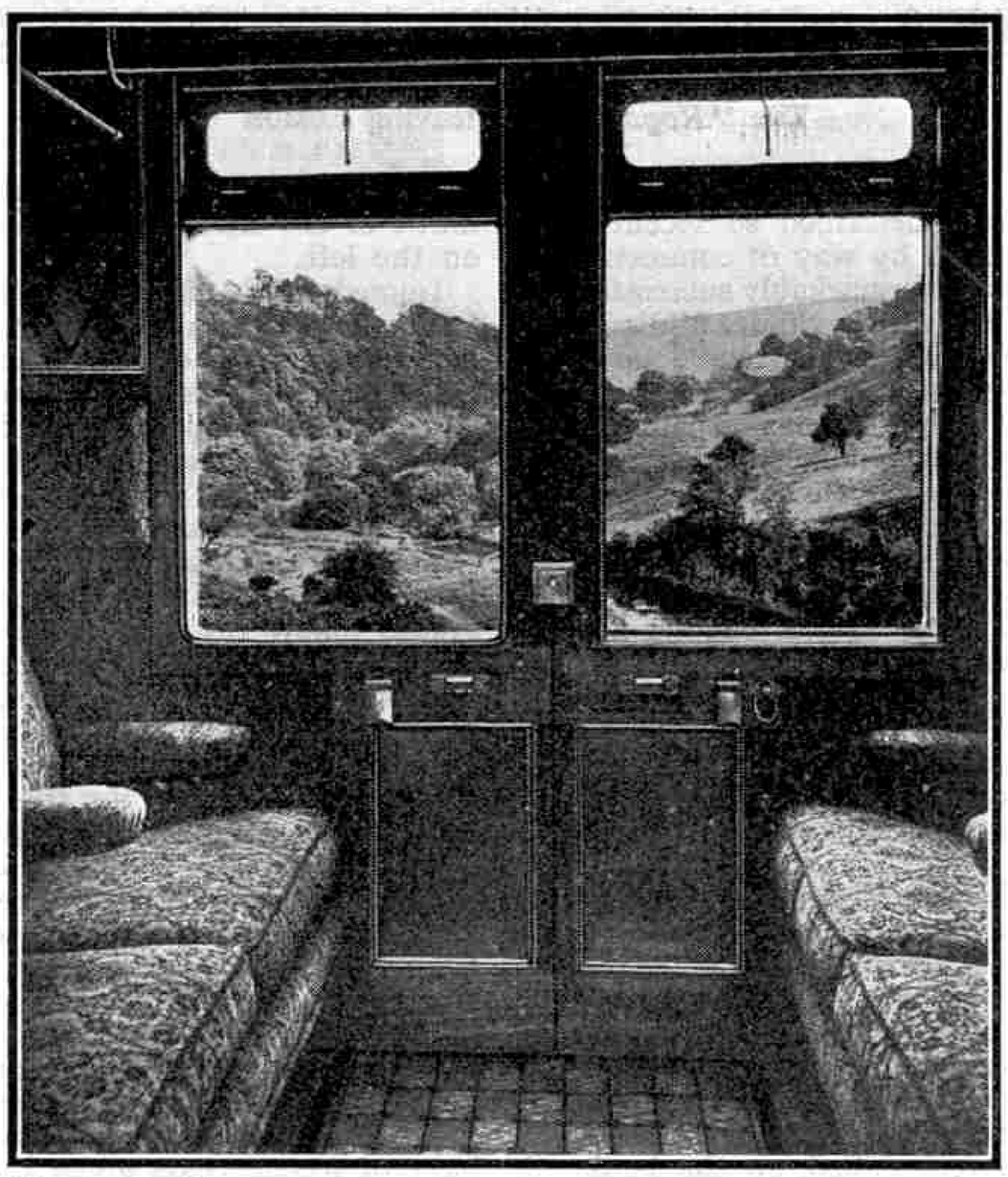


Photo courtesy] [*L.M.S. Railway*

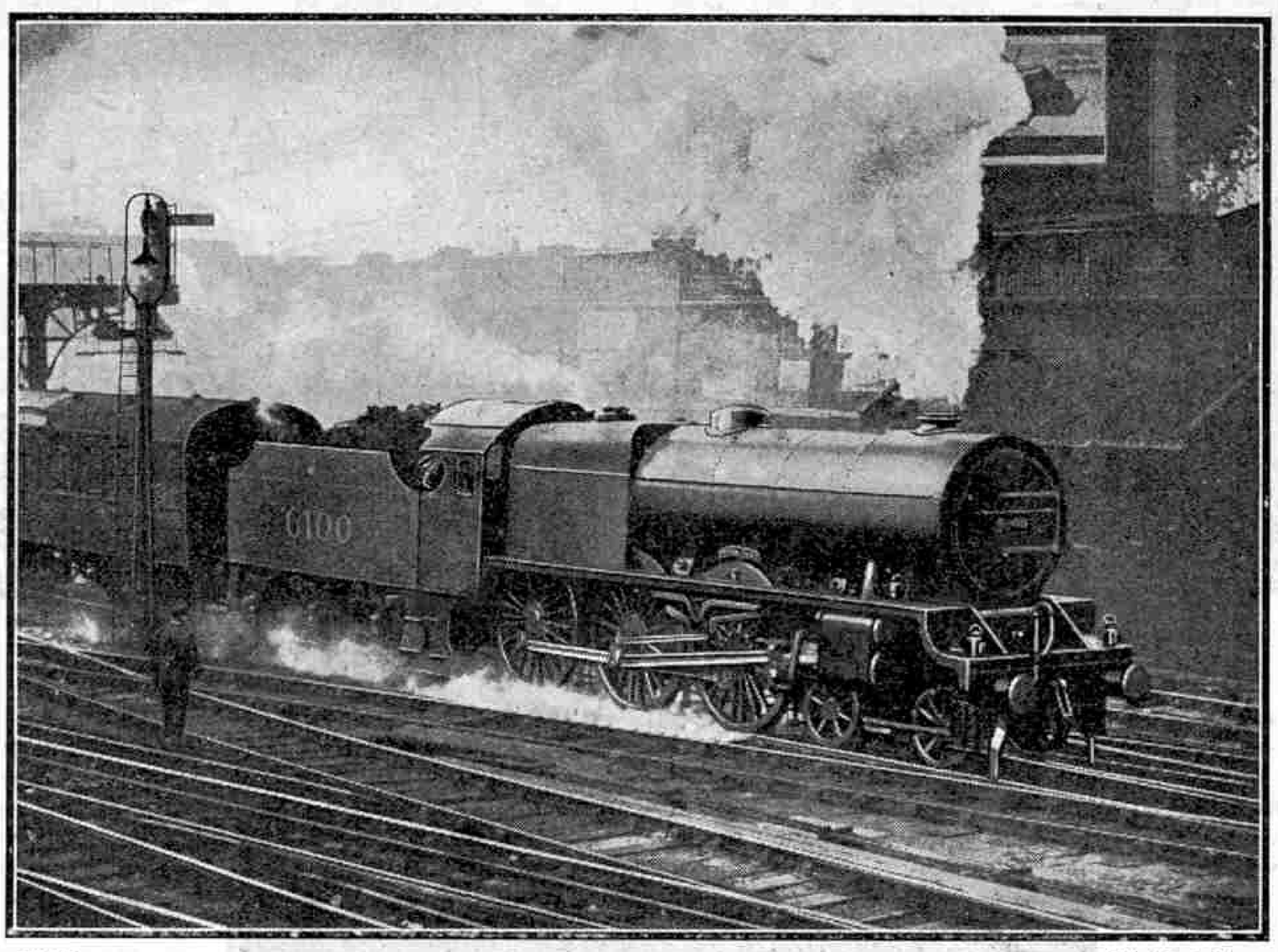
Interior First Class corridor coach, "*Royal Scot*"

Nothing of more handsome external appearance could be imagined than this magnificent train, with its coaches uniform in size and outline, each bearing on the roof sides the neat legend "*The Royal Scot*," in black letters on a white ground, and with both carriages and engine of the same familiar "Midland red" colour. The standard summer formation, as previously mentioned, consisted of 15 coaches, weighing empty

417 tons. Backward from the engine there were nine vehicles for Glasgow, consisting of bogie brake, corridor first, open first-class restaurant car, kitchen car, two open third-class cars in succession (one reserved for meals only), two third-class corridors and a third-class brake; and then for Edinburgh first-class corridor brake, open first, kitchen and open third restaurant car set, third-class corridor coach and third-class brake.

No less than six vehicles in the train, weighing in all 170 tare tons, were thus devoted to the service of meals, leaving, apart from the three brake coaches (equivalent to two coach-lengths of brake space) only seven vehicles out of 15 actually devoted to the carriage of passengers. The enormous increase in train-weight represented by the present 10 a.m. and 10.7 a.m. expresses out of Euston — as compared with the previous one train only at 10 a.m. —is thus explained.

For the winter the train has been cut down to 12 vehicles. One of the third-class corridor coaches has been withdrawn from the Glasgow portion and the Edinburgh portion consists of first-class brake, composite twelve-wheeled restaurant car, open third-class car and third-class brake, which reduces the tare or empty weight of the train to 350 tons. With an average complement of passengers and luggage this represents about 365 tons, whereas the total weight in summer was more like 440 tons, and occasionally, when the load was made up to 17 coaches, must have exceeded 500 tons.



Photo] [*Topical Press*

The "*Royal Scot*" leaving Euston

The "Royal Scot" engines have been described so recently in the "*M.M.*" that little further is needed by way of comment. The only matter for surprise is that, after the remarkably successful experience of the L.M.S. Company with the three-cylinder Midland compounds, three-cylinder simple propulsion should have been adopted without so much as an experimental building of an engine of this type on compound lines. The only previous experience of any section of the L.M.S. with three-cylinder simple working was that of the Caledonian, where, however, the big Pickersgill three-cylinder 4–6–0 engines have not proved as successful as anticipated, the cost of maintenance in particular being somewhat heavy.

As compared with the other British express locomotive giants of recent date, too, the cylinders of the new L.M.S. engines are somewhat on the small side, with the result that, despite the high working pressure of 250 lb. per sq. in., their tractive effort is less than that of either the Great Western new "Kings," the rebuilt L.N.E.R. 4–6–2 engine "*Enterprise*," or the Southern "*Lord Nelson*." But actual performance is the truest test of tractive capacity and in this respect it is clear that the new "Royal Scots" leave little to be desired.

The only assistance that will be taken throughout the north-bound journey—unless, possibly, the weather should prove very bad over the mountainous sections further north—is up the incline from Euston to Camden. This begins right off the end of the platform and is for 1¼ miles at between 1 in 70 and 1 in 105. At the opening of the London and Birmingham Railway it was never supposed that the ordinary adhesion locomotive would surmount such a grade without help, and a winding engine was installed at Camden by which outgoing trains were pulled up the bank before the engine was attached that was to draw them northward. The same practice obtained until a much later date up the 1 in 42 of Cowlairs bank out of Queen Street Station at Glasgow. In both cases rope haulage has long since been abandoned in favour of rear-end assistance by the engine that has brought the coaches into the terminus.

Thus aided, we mount Camden bank with ease, and have now before us no grade of steeper inclination than 1 in 330 for the next 150 miles. As far as Crewe, or even Warrington, indeed, the West Coast main line has, for its length, the finest and flattest grading in Great Britain, with the exception of Brunel's old main line of the Great Western from Paddington to Swindon, Bath, Bristol and Taunton. In the earlier stages of the run, therefore, the miles will be reeled off steadily and easily, little in the way of comment on the journey being needed.

After a level run of four miles from Camden we shall pass Willesden Junction at 60 miles an hour, or slightly under. The next 26 miles up to Tring, where the line is roughly on a level with the top of St. Paul's Cathedral, are mostly on the ruling up-grade of 1 in 330, with a break of about three miles past Watford where again we shall touch or slightly exceed the mile-a-minute rate. The sustained up-hill speeds will be round about 50 miles an hour. Schedule times allowed are 10 min. to Willesden, 24 to Watford and 41 to Tring, where we are 31¾ miles from Euston. In the course of this initial stage we have taken water from the first of nine sets of track-troughs between Euston and Carlisle, these being located at Bushey.

Once over Tring Summit we have before us a booking of 14 min. for the 15 miles from Tring to Bletchley, and may attain here a speed of 70 an hour or slightly over between Cheddington and Leighton. The line is level or falling as far as Wolverton, where the large carriage works at which so much of the L.M.S. passenger stock is turned out may be seen on the left.

Immediately after this there come Castlethorpe troughs, followed by a 1 in 330 ascent to Roade, noted for its remarkable cutting, 80 ft. in depth. Here we are 60 miles from the start, which have required 68 minutes of running time. At Roade the Northampton loop line leaves on the right, reminding us of the early opposition to railways that has now for all time carried the West Coast main line some three miles away from the county town, to the serious loss of the latter.

The Northampton loop comes in again at Rugby and meanwhile our main line converges from four tracks to two. Easy grades follow through Blisworth and Weedon, with a rise from the latter to Kilsby Tunnel, during the ascent of which the Daventry Station of the B.B.C. is a prominent object on our left. Immediately after Kilsby the far more imposing Government wireless station at Rugby bears into view on the right. Speed must be reduced to 40 miles an hour for the passage of Rugby. We now have covered 82½ miles in 92 minutes from the start.

At "Rugby No. 7" signal box, half a mile beyond the station, the original London and Birmingham Railway leaves us on the left and we shall not rejoin it until Trent Valley Junction, just before Stafford. The Trent Valley line, as it is called, only saves 7¾ miles in distance over the old route, but it avoids all the congestion through Birmingham and Wolverhampton. It consists of a series of gentle ups-and-downs, the points of maximum speed being Nuneaton and Polesworth, where we may again reach the "70" level. Beyond the latter station adjacent colliery workings have of recent years given trouble to the railway in the way of subsidences, and our speed probably will be moderated between Polesworth and Tamworth. Water has been taken from troughs just beyond Rugby, and at Hademore, between Tamworth and Lichfield; the next supply is obtained at Whitmore, 148 miles from the start—the summit of a gentle rise from Stafford.

A time of 54 minutes amply suffices for the 51 miles from Rugby to Stafford, where speed is reduced to 40 m.p.h. for the junction

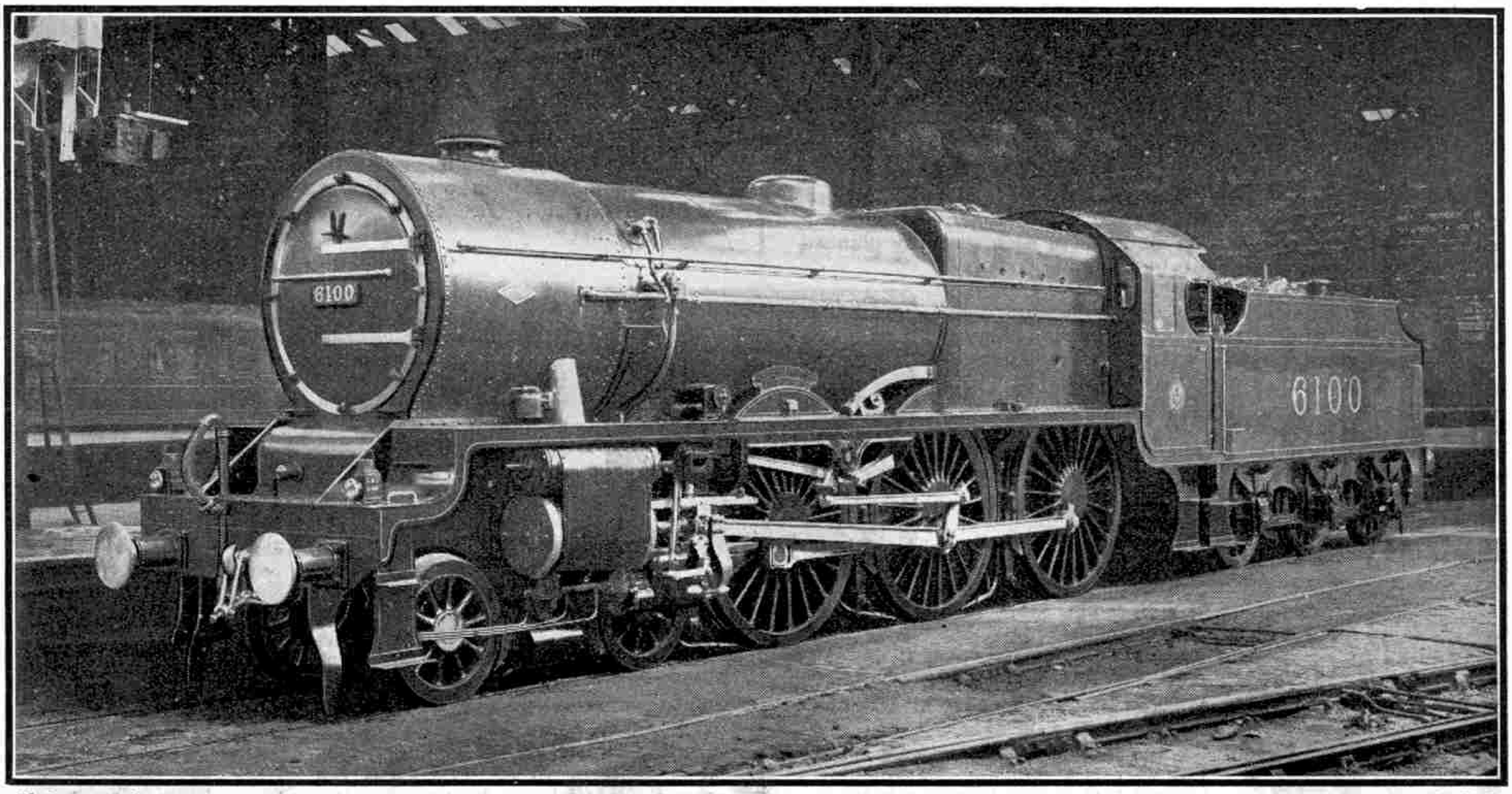


Photo courtesy] [*L.M.S.*

L.M.S. 4-6-0 three-cylinder express locomotive No. 6100 "*Royal Scot*"

with the Birmingham line. Then 18 min. is allowed for the 14 miles up to Whitmore and 11 min. for the 11½ miles down to Crewe. From Madeley down to Betley Road is the steepest grade since Camden—three miles at 1 in 177—which may produce a maximum rate of 75 an hour, ere we roll slowly through Crewe Station at 12.55 p.m. We have covered 158 miles.

From Stafford to Crewe is four-track main line, and this has now been extended over a good proportion of the ensuing 51 miles to Preston. At first the gradients are favourable beyond Crewe, as far, indeed, as Warrington, but there is a sharp rise for two miles at 1 in 132 beyond Winwick Junction, and from Wigan up to Boar's Head the gradient is as steep as 1 in 104 for roughly the same distance. Despite slight easings of the speed through Weaver Junction—where the Liverpool line diverges—Warrington, Wigan and Euxton Junction, however, the 51 miles from Crewe to Preston, begun and ended at a very low speed, must be covered in the even hour.

Speed must be recovered up a short but very steep incline out of the great station at Preston, but then follow some 20 miles of practically level line, terminated by a mile descent at 1 in 96 round some sharp curves into Lancaster, whence we soon strike the shores of Morecambe Bay at Hest Bank. This two or three miles of seashore gives the West Coast passenger his only actual glimpse of the West Coast of Great Britain throughout the journey. Between Crewe and Carnforth, now about to be passed, there are three sets of track-troughs—at Moore, just before the line rises on to the high bridge of the Manchester Ship Canal, near Warrington; at Brock, eight miles beyond Preston; and at Hest Bank. Carnforth, 236¼ miles from the start, is passed at 2.24 p.m.

Now comes the ascent to Shap. It is in three stages—first a short climb for 2½ miles at 1 in 134, followed by a level strip from Burton to Milnthorpe; then the 13 miles of Grayrigg Bank, steepening from Oxenholme to an average of 1 in 131 for 7 miles and finishing with two miles at 1 in 106 up to Grayrigg Station; then again some five miles of level through a fine mountain gorge until, just after Tebay, we strike the final pitch, which is for four miles at 1 in 75 to Shap Summit. The "*Royal Scot*" is not unduly hurried on this 900-ft. climb; the schedule allowance over the 31¾ miles from Carnforth to Summit is, in fact, 47 min., after which a swift run of 32 minutes carries us over the remaining 31¼ miles into Carlisle. Speed will fall, probably, to 30 miles an hour or so in the ascent of Grayrigg Bank, and after a maximum of 60 to 65 an hour through Tebay we may fall yet further to as low a figure as 20 an hour before breasting Shap Summit.

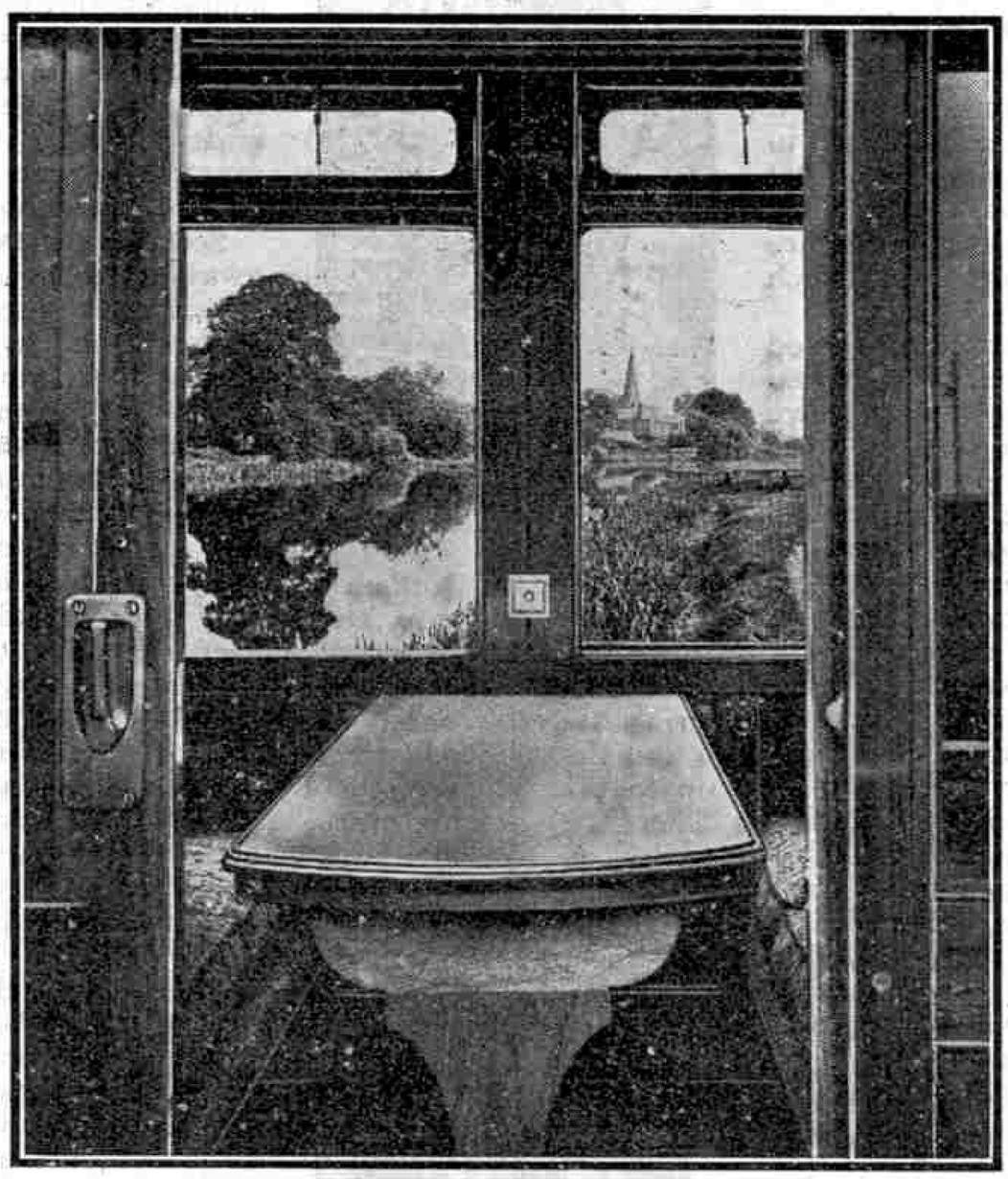


Photo courtesy] [*L.M.S.*

Interior First Class corridor coach "*Royal Scot*"

Should the express be behind time, we may attain a high speed in descending the long 1 in 125 from Shap to Penrith, even in excess of 80 miles an hour, but the speed is not generally allowed much to exceed 70 an hour. Carlisle is reached at 3.45 p.m., and our "Royal Scot," with his crew, is doubtless glad enough to hitch off and amble away to the engine-shed for well-earned rest.

Another "Royal Scot" now takes his place. Getting away from Carlisle at 3.50 p.m., the new engine has a comparatively easy schedule ahead, Beattock Bank notwithstanding, the 102½-mile journey being allowed 140 minutes. Beattock Summit divides the 100 miles into two almost exactly equal parts, being 49¾ miles from Carlisle. For the first 39¾ miles to Beattock Station, where in the old days the stop was made for the "banker," the ruling grade is 1 in 200. This occurs in no inconsiderable stretches, some 15½ miles in all of the distance being upward

(*Continued on page* 1097)

New Books for Christmas

"Engineering Wonders"

(Ward, Lock. 6/-)

The 1927 addition to the well-known series of "Wonder Books" will be of greater interest than usual to our readers, as it deals with Engineering wonders. It might have been specially planned for Meccano boys, for it presents by word and picture a comprehensive idea of the world's greatest feats in Engineering and the principles that have rendered them possible. There are many indications that the age now dawning will witness developments compared with which even those of the last 100 years will seem trifling and for those who wish to follow what is happening, this volume with its hundreds of photographs and articles by well-known engineering experts, will make interesting reading this Christmas.

The book contains over 300 illustrations, including 12 coloured plates, all of which have been specially painted for this volume. The principal articles include "The Story of Iron and Steel," "Famous Bridges," "The World's Largest Locomotives," "Wonderful Airways," "Cranes—The Engineer's Levers," "Some Wonderful Docks," "The Engineer as a Builder," "Launching a Liner," "How the Engineer helps the Miner" and numerous other articles of equal interest.

No doubt our readers will be interested to know that several of the articles have been contributed by the Editor of the "*M.M.*"

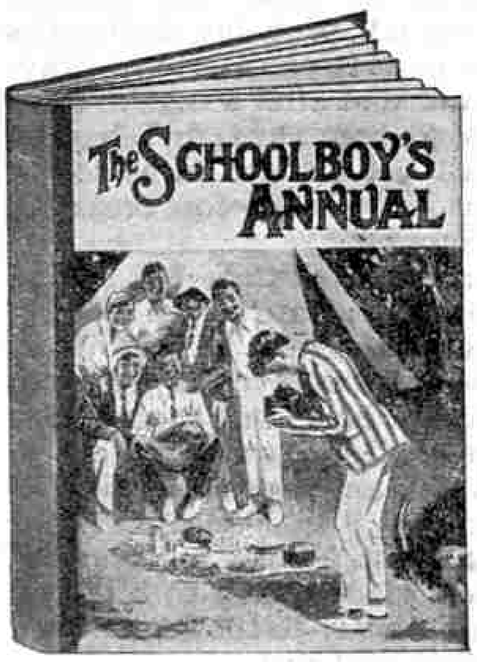
* * * *

"The Boys' Own Annual"

(R.T.S. 12/6 net)

The present volume is the 49th of this well-known annual and it quite maintains the standard set in previous years. As usual there are more than 700 pages of reading matter and illustrations. The latter are as good as ever, and once more a special feature is made of the splendid coloured plates to which readers of the Annual are accustomed.

The serial stories this year are particularly good and unusually varied in character. The two best are perhaps "The Flying Beetle," a very exciting yarn telling how plotters against the British Empire were foiled by a mysterious airman, and "Into the Hands of Spain," a thrilling story of adventure in the days of Drake and Raleigh. The other serials are little inferior to these two and the shorter stories are fully up to the best "B.O.P." standard. There is a splendid collection of articles on subjects ranging from wireless, stamps and photography to outdoor sports and games of all kinds, and mention must be made of a particularly interesting series of articles on "Scouting in Other Lands." Practical articles of the "how to make" kind are given prominence and form a feature of great value. There is no doubt that this volume will be as enthusiastically received as its 48 predecessors.



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"The Schoolboy's Annual"

(R.T.S. 3/6)

This is an excellent collection of stories of medium length ranging from tales of school life to exciting yarns of secret service and adventures in wild and remote parts of the world. Each story is well illustrated and in addition there are four very fine plates in colour. From beginning to end the volume maintains a very high standard of excellence and as a Christmas gift it is sure to prove very acceptable to any boy.

* * * *

"The World's Locomotives"

By G. Gibbard Jackson. (R.T.S. 5/- net)

Mr. Jackson's latest publication forms an ideal gift for any railway enthusiast who is specially interested in the locomotives themselves. In an earlier work the author has dealt with the railways of Great Britain from a general point of view and in the present volume he confines himself to an interesting description of the development of the locomotive, followed by a comprehensive survey of locomotives throughout the world. The section dealing with foreign railways is of particular interest on account of the inclusion of sufficient dimensions to enable the reader to form a sound estimate of the capabilities of these unfamiliar locomotives and to compare them with those he sees in operation every day. The book is profusely illustrated with photographs of locomotives of all types and the examples have been chosen very skilfully with reference to the text.

* * * *

"The Scout Annual"

(C. Arthur Pearson Ltd. 10/6 net)

This Annual continues to develop on its own characteristic lines and the present volume is in every way worthy of its predecessors. Scouting of course figures very largely, and almost every phase of Scoutcraft is dealt with in an interesting and thoroughly practical manner. The yarns of the Chief Scout himself, of course, need no recommendation.

Scouting forms only a part of the attractions packed away in the thousand pages of this Annual. There are no less than 13 serial stories, many of them so exciting that no boy can fail to be thrilled as he reads them. Their subjects range from mysterious airships to adventures among pre-historic monsters in an unexplored swamp, and Indians and cowboys are there in plenty. Numerous short stories of adventure and school life, including a series of clever detective yarns, complete the fiction side of the Annual. Well-written articles on various practical subjects are as usual a prominent feature. All the articles and stories are splendidly illustrated and boys who become possessors of this fine volume will be fortunate indeed.

* * *

"Modern Travellers"

(Collins. 1/6)

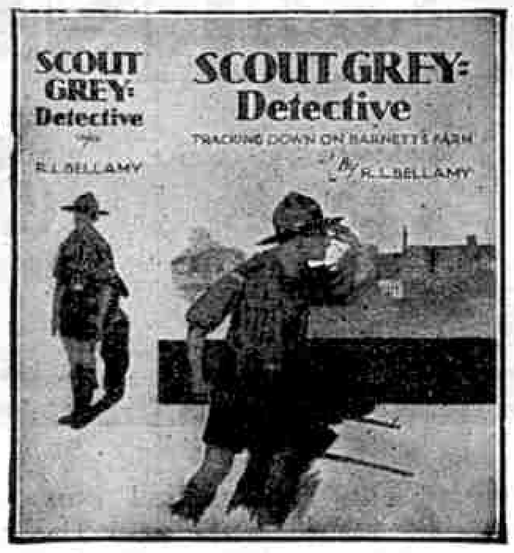
That ladies are capable of taking their share of exploration work is evident from the fact that two of the explorers dealt with in this book are ladies. One, Miss C. J. Gordon-Cumming, gained fame by her travels in many lands and by the books she wrote about them. She travelled in India, China and Ceylon—a word which is supposed to mean "Lion Island," although the King of Beasts has never existed in the country.

This volume is one of the Great Adventure Library, a series that deals with the exploits of the old navigators and explorers and of modern travellers, and it provides fascinating reading for boys who like true stories of travel and adventure.

"Scout Grey : Detective"

By R. L. BELLAMY. (Sampson Low. 2/6)

The action of this story takes place at the beginning of the war, when Bryce is rejected by the Army authorities, and takes up work as a farm-hand to help the country to the best of his ability in that way. Adventures commence very soon and ghostly apparitions, midnight shrieks and groans, spirit rappings and ringing bells disturb the peace of an old farmhouse and reduce the occupants to a state of terror. Scout Grey determines that ghosts must be laid and mysteries solved, and the riddle of the old document read, so Bryce and he, with the Farmer's permission, put their heads together, but despite their keen wits and enthusiasm are baffled many times. This is a really "creepy" ghost story.



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A BATCH OF SCHOOL STORIES

"Old Nick of Pig's"

By R. L. BELLAMY. (R.T.S. 3/6 net)

"The Fellows of Ten Trees School"

By R. A. H. GOODYEAR. (Sampson Low. 2/6 net)

"The Lion's Whelp at School"

By ROWLAND WALKER. (Sampson Low. 2/6 net)

The story "Old Nick of Pig's" is excellent of its kind. It displays considerable knowledge of the inner mysteries of life in a big school and the characters of the boys are well depicted. The plot, however, is on lines that have become too familiar by constant repetition, and one doubts whether the most skilful writer in the world could now make a success of it. The book is nevertheless thoroughly readable and will appeal in particular to the younger generation of schoolboy readers.

"The Fellows of Ten Trees School" is mainly concerned with the rather trying position of a boy whose grandfather had left money to his old school but on conditions that made the bequest a heavy burden to the head master. The story contains plenty of exciting incidents, including an attempted murder by a science master whose brain had gone wrong, and humour is amply provided by the hero's cockatoo, which invariably says the right thing at the wrong moment.

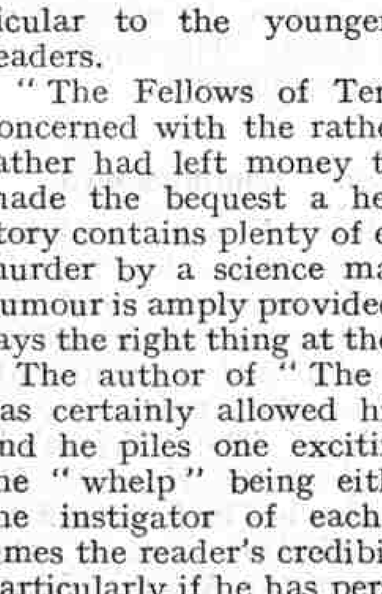
The author of "The Lion's Whelp at School" has certainly allowed his imagination to run riot and he piles one exciting incident upon another, the "whelp" being either the leader or at least the instigator of each individual escapade. At times the reader's credibility is strained to the limit, particularly if he has personal experience of a school of the type described, but in spite of this defect and certain irritating mannerisms that occur all too frequently, the book has a swing that carries the reader along.

* * * *

"The Cousins of Falkland"

By THEODORA W. WILSON (R.T.S. 5/- net)

The plot of "The Cousins of Falkland" by reason of its originality comes as a pleasant change from the majority of books for youngsters. A practical joke played by an artist immediately before his death causes years of struggle and unhappiness to his son. The unfailing loyalty of the boy to his father's memory in face of opposition and ridicule has its reward, and in the end the mystery is solved at a very unexpected moment. The characters in the story are all thoroughly natural and the reader follows their doings with keen interest from first to last. The attractiveness of the book is increased greatly by a first-rate coloured frontispiece and other effectively drawn illustrations.



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"The Kidnappers"

By PETER BLUNDELL. (Ward Lock. 5/-)

The boy with a taste for thrills will be well satisfied with this tale of the riotous adventure of two boys, kidnapped by a Malay Sultan and taken aboard his yacht and borne away as prisoners. There are Malay rogues, and Chinese plotters, and a gruff old European in the Sultan's crew, who is a fascinating figure. The British boys keep smiling and it seems incredible that they will ever emerge alive from their adventures! Pluck and brains work wonders, however, and it is with regret that we finally bid them farewell.

* * * *

"Pat of the Pony Express"

By HAYDN DIMMOCK. (Pearson. 3/6)

In this book the author has told in his usual dashing manner the thrilling story of the inauguration of the Pony Express and the events that accompanied it. The result will thrill the heart of every boy with admiration for the splendid men who rode over rough country, by night as well as by day, guiding themselves often by the stars, the direction of the wind, or some other means known to expert plainsmen. They braved attacks by Indians and "road agents" (as highwaymen were picturesquely called) and took all the risks in order to get the precious mails through to schedule time.

The riders changed horses about every 12 miles, each man riding roughly 80 miles at a gruelling pace, with his life in his hands every inch of the way. In addition to road agents and Indians, the magnificent riding and the thrilling adventures of the hero and his friends, there is a mystery to be unravelled. In short this is as fine a "wild west" tale as any boy could long for.

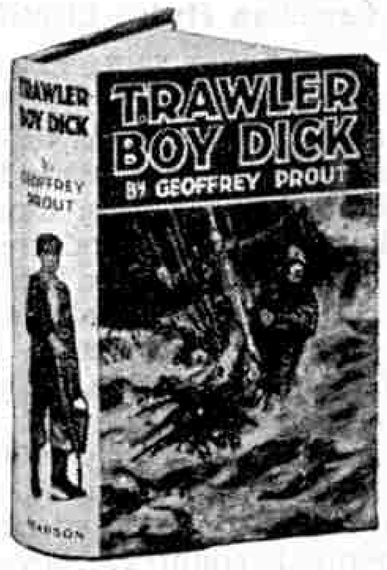
* * * *

"The Way to Burning Mountain"

By DILLON WALLACE. (R.T.S. 3/6)

This popular author has given us another excellently written story with a very unusual touch about it. Jerry's father had reached the country where the Indians feared to tread—The Lake of Skulls and the Burning Mountain—and from there had sent word that he had found "deposits of so great value that I cannot even vaguely calculate their worth. We have found a veritable treasure mine."

No further word came, however, and the expedition was given up as lost. Relief was sent, but failed to find the land in which the adventurers were last heard of. Then, many years afterwards, certain clues come into Jerry's hands and he starts off in search of his long-lost father.



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"Trawler Boy Dick"

By GEOFFREY PROUT (C. A. Pearson. 3/6 net)

This is a story of the Devon fishing fleet that will appeal to every boy who loves the sea. It deals with Dick Ryland's first trip to sea in a Brixham trawler and gives a vivid picture of the dangers and hardships of the life, and also of the wonderful fascination of the sea that causes these conditions to be endured gladly. There are many thrilling episodes in the story, which is well illustrated.

25,000-Ton Floating Dock for France

A new 25,000-ton floating dry dock has recently been constructed by the Vulcan Company at Hamburg and delivered to France under the Dawes Reparation Scheme. The dock, which is to be stationed at Bordeaux is 720 ft. in length and has an available breadth of 110 ft. for docking ships. It can be submerged to accommodate ships drawing not more than 29 ft. The pumping plant has been designed to deal with 25,000 tons of water in two hours, which means that the docking of the largest ship that it is capable of accommodating will occupy a period very little more than 2½ hours. Compressed air and electric power equipment is provided for repair work, and the dock is fitted with its own electric power station for generating purposes.

* * * *

Salvage Operations at Scapa Flow

The salvage work on the scuttled German fleet lying in Scapa Flow is rapidly being pushed forward. Recently the battle cruiser "*Moltke*" which, it will be remembered, turned turtle, was towed three miles from the island of Cava, where it was beached in June last, to a position close into the beach at Limos Pier. This feat is almost unparalleled in the history of marine salvage operations. It was necessary to make watertight all apertures in the vessel's hull and to apply air pressure inside until the 23,000-ton ship was partially buoyant. The propellers were removed and hundreds of tons of plating were taken out to lighten the ship to a degree sufficient to make the task possible.

Work is now going forward on the "*Seydlitz*," which is lying on her side in close proximity to the sunken battle cruiser "*Hindenberg*."

* * * *

Canadian Hydro-Electric Developments

The Grand Falls hydro-electric scheme for the supply of power for pulp and paper mills in New Brunswick is rapidly going ahead, and is now ready for the installation of machinery. The dam on the river is almost complete and the 2,700 ft. tunnel, which passes under the principal business section of Grand Falls, carrying the water to the three generators, is also well ahead of its programme. The scheme when completed will make available an electric supply developing 60,000 h.p.

This is one of many schemes that are rapidly turning Canada into an electrically operated country. Several big schemes for development on the River St. Lawrence are under consideration, but are held up by an agreement concluded between Canada and the United States, until some arrangement can be reached concerning the countries' joint rights over the river. Both the Lachine and Long Sault Rapids on the St. Lawrence River are entirely within Canadian territory, however, and from the former alone electric energy to the extent of 500,000 h.p. could be developed.

* * * *

A New Speed Boat

Mr. Bugatti, the well-known motor car manufacturer, has constructed a motor boat of novel type with which he hopes to attain a speed of nearly 80 miles per hour. The boat is 115 ft. in length with a beam of 8 ft. 2 in., and will be equipped with eight aero engines developing a total of 2,300 h.p. Six engines will drive the boat forward and two will be used for reversing. On calm seas the boat will cut through the surface of the water, but in rough weather it will go through the waves until it is almost awash. For this reason the navigating bridge is enclosed and provided with a ventilation shaft that will close automatically when driving through big waves.

* * * *

Towns to be Destroyed to make Reservoirs

Three historic New England towns, Enfield, Greenwich, and Prestcott, in the Swift River Valley, Massachusetts, are to be wiped out to make way for a huge reservoir destined to provide a further water supply for the city of Boston. For several years past an increased rate of consumption, in conjunction with a decreased rainfall, has threatened to render the existing water supply insufficient for the city's needs and the new reservoir is to be constructed to cope with the situation. A tunnel will be driven through the hills to link up with the existing Machusett reservoirs on the Ware River. The new dam will hold up several additional rivers and streams, and the situation on each side of the great mid-Massachusetts watershed is such that the interconnection of the reservoirs will make it possible to collect water on one side of the hills and pass it down the other. The scheme will render homeless nearly 2,000 people, all of whom are to be indemnified by the State.

* * * *

Tunnel Through a Welsh Mountain

Two men met recently in the heart of a Welsh mountain. They were the engineers in charge of the tunnelling through the base of a mountain separating Lakes Cwlyd and Eigiau, and the scene was the meeting of the two tunnel headings in the centre of the mountain. For 2½ years men have been working on both sides of the mountain, driving a bore 7 ft. 8 in. in diameter toward one another, and a remarkable demonstration of the exactness of the operations is that the engineer in charge calculated, nine months before the completion, that the two headings would meet almost at the very hour that the gap separating the two parties actually was broken through!

The tunnel is intended to provide a passage for millions of gallons of Lake Eigiau's waste water into the vast storage area provided by Lake Cwlyd. The scheme has been carried through for the North Wales Power Company.

* * * *

The Tees Dock Scheme

Work is to be commenced at once on the Tees Conservancy Commission's scheme for developing the port of Middlesbrough. The river is to be widened and deepened so that it will accommodate the largest liners afloat. Large areas of land are to be reclaimed and the development will extend as far as Stockton, 10 miles from the mouth of the river. The estimated cost of the scheme is £500,000.

* * * *

H.M.S. "*Nelson*" Commissioned

The new battleship "*Nelson*," a photograph of which we reproduced last month, has recently been commissioned and appointed to the Atlantic Fleet as Flagship. It is interesting to note that the ship took up its commission on the anniversary of the battle of Trafalgar. The "*Nelson's*" commander is Captain the Hon. M. R. Best, D.S.O., who also is Chief of Staff to Vice-Admiral Sir Herbert Brand, the Commander-in-Chief of the Atlantic Fleet. By the time this note is published it is probable that H.M.S. "*Rodney*," sister ship to the "*Nelson*," also will have been commissioned.

* * * *

A New Cruiser

The sixth cruiser of the new County Class, H.M.S. "*London*," was recently launched at Portsmouth by Lady Blades, the Lady Mayoress of London. The ship is one of four that differ slightly from the earlier batch of County Class vessels, the remaining three being the "*Devonshire*," "*Shropshire*," and "*Sussex*."

The "*London*" will have a displacement of 10,000 tons and its speed will be somewhere between 31½ and 33 knots. She has the extremely large fuel oil capacity of 3,400 tons, and therefore will have a considerably greater range of action than her predecessors. She will be armed with eight guns of 8 in. calibre.

Mersey Tunnel Progress

The construction of the new Mersey Tunnel is going ahead very quickly and half the distance separating Birkenhead and Liverpool has already been tunnelled. The actual length of tunnel already driven is 9,300 ft. and it is anticipated that the headings from each side of the river will meet in May next. The lowest part of the rocky bed of the river has already been passed from the Liverpool side and the remaining distance is not expected to cause any anxiety.

* *

Electricity in South-East England

The second of the great electric supply co-ordination schemes has now been prepared by the Electricity Commissioners and submitted to the Central Electricity Board. This scheme covers an area of approximately 8,800 sq. miles in the South-East of England and embraces the whole of eleven counties, including London, Middlesex, Surrey, Kent and Essex, and parts of three others. The area covered is of considerable importance, for in addition to supporting a population of over 11½ millions it includes the big industrial areas of Thames-side.

At present the area is served by 135 generating stations and of these 13 have been selected to serve as main stations. Five new main stations will be brought into operation later and between them these 18 will take over the main portion of the generating work, distributing through overhead 132,000 volt transmission lines to 25 transformer stations, from which the current will be distributed to the secondary stations at various voltages.

The estimated cost of the scheme, which it is hoped will be operating to some extent by August next year, is £6,500,000 to the Central Electricity Board, and in addition a further £5,500,000 will be spent on extensions by the owners of the 13 selected stations.

* * * *

A new bascule bridge to replace the old North Bridge is to be built across the river Hull, at a cost of £86,000. The work forms part of a large street improvement scheme embarked upon by the Kingston-upon-Hull Corporation, and is to be completed in 2½ years.

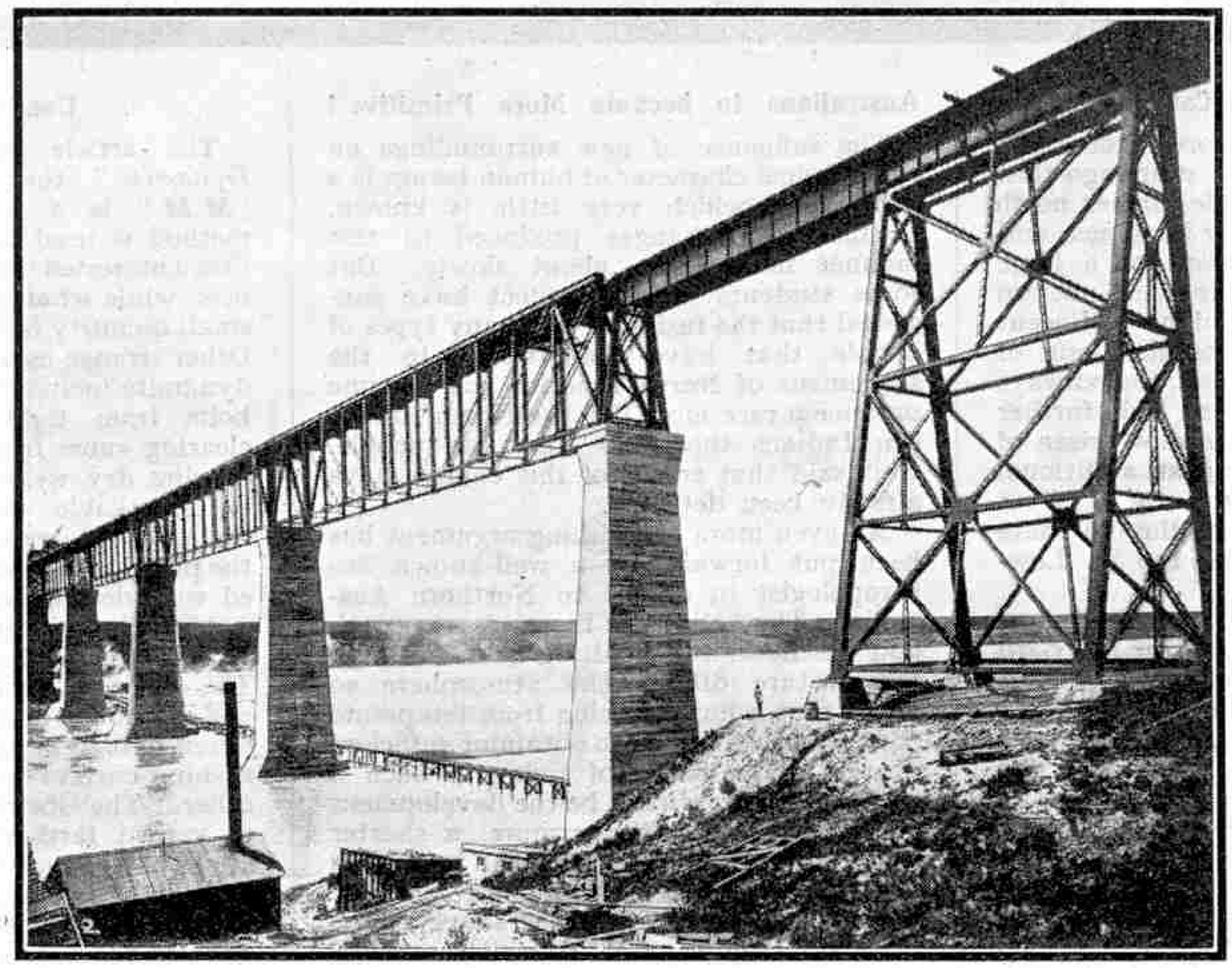
* * * *

The tallest concrete chimney stack in the North American continent has recently been completed in Quebec. It is 409 ft. in height, 31 ft. in diameter at the bottom and 20 ft. in diameter at the top outside.

World's Largest Suspension Bridge

Work has been commenced on the new suspension bridge across the valley between New York City and Fort Lee, New Jersey. The bridge is to be a mile-and-a-half in length and, it is claimed, will be the largest of its type in the world. The great suspension towers will be 620 ft. in height. The estimated cost of the bridge is £12,000,000.

A Fine Canadian Bridge



This bridge, 140 ft. in height, is on the Canadian Pacific Railway and crosses the South Saskatchewan River

World's Largest Aerial Ropeway

In connection with the Nag Hammadi Dam over the River Nile, concerning which we published a note in our last issue, we learn that Sir John Jackson Ltd., the contractors, are constructing an aerial cableway consisting of five ropeways of the luffing type to span 3,100 ft. from bank to bank of the river, for the purpose of transporting men and materials during the course of the work. This aerial ropeway is the largest in the world, and altogether 22½ miles of steel wire rope will be required. The cableway will be supported by masts 182 ft. in height placed on each bank. The ropeway is to be constructed to handle loads weighing up to five tons and these will cross the river at a speed of 1,250 ft. per minute.

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The annoying frequency with which the traffic control signboards used on the streets of Chicago have been damaged has led to the introduction of a new type of post made of rubber and standing 2 ft. in height. If a motor vehicle collides with one of the new posts this simply bends back flat on to the ground and when the vehicle has passed it springs back into its upright position.

New Steamers for Southern Railway

The Southern Railway have undertaken an expenditure of nearly £300,000 on additions to their steamship fleet and arrangements are being made for several new vessels to be delivered in time for next summer's traffic. The principal new ship is a twin-screw oil-burning vessel for the Newhaven-Dieppe Service. It will operate on the joint service worked by the Southern Railway and the French State Railways, but will run under the British Flag.

The new vessel will be named "*Worthing*" and her principal dimensions will be:—Overall length 206 ft.; breadth (moulded) 38 ft. 6 in.; depth (moulded) 15 ft. 9 in.; speed 24 knots. The propelling machinery will consist of two independent sets of Parsons' single reduction geared turbines driving two shafts and two propellers. There will be passenger accommodation for about 1,100 and sleeping accommodation for 176 first-class and 140 second-class passengers. The "*Worthing*" will replace the s.s. "*Sussex*," which was torpedoed in March, 1916, and subsequently sold. The addition of this vessel will restore the Newhaven-Dieppe passenger fleet to its pre-war number.

In addition, two new passenger paddle steamers for the Portsmouth-Ryde (Isle of Wight) service are to be built. They will be named "*Merstone*" and "*Portsdown*" and their principle dimensions are:—Length 185 ft.; beam 24 ft. 6 in.; speed 13½ knots. Each will provide accommodation for 600 passengers.

A fourth new vessel will be a cargo boat for the Dover-Folkestone Service. This will be named the "*Deal*," and her gross tonnage will be 685, length 229 ft., breadth 33 ft. and speed 15 knots.

* * * *

London-Canada Telephone Service

A telephone service has been inaugurated between Great Britain and Canada. At present the service is available every day, but is restricted to subscribers in the London area at the English end, and Ottawa, Quebec, Montreal, Toronto and Hamilton (Ontario) at the Canadian end. The service is being worked in conjunction with the existing wireless telephone service to New York, the connection with the Canadian stations being by landline from the U.S.A.

New Seaports for Canada

The famous Arctic explorer Stefansson expressed the opinion some years ago that wheat growing was possible further north in Canada than was usually imagined, and he pictured the development of a large grain-growing community in the Northern Provinces of the Dominion. Recent developments seem to be on the point of proving his ideas to be correct, for railways are being pushed further and further north, and the question has now arisen of the possibility of providing an additional outlet for Canada's wheat by way of Hudson Bay, in addition to the old route down the Great Lakes and the St. Lawrence River.

A glance at the map of Canada will show that Hudson Bay is the nearest seaboard to the districts of Canada in which wheat is grown at the present time. If it were possible to export wheat from a port on the Bay, two shipment transfers on the Great Lakes would be eliminated, and in addition the journey to Europe would be shortened by two days.

The real crux of the problem is the possibility of using Hudson Strait, the narrow channel between the northern end of Labrador and Baffin Land through which ships must pass to reach the Bay. Ice and fog conditions in the Strait make navigation impossible during the greater part of the year, and an attempt is to be made to discover whether it is possible to ship grain by this route during the summer months.

As announced in the "*Air News*" in the "*M.M.*" for July last, an aeroplane survey of the Strait on a very large scale is to be carried out. Two ships are proceeding north with six machines and equipment for an expedition to last 16 months. Huts are to be erected on the shores of the Strait for the accommodation of the surveyors, who will fly winter and summer alike in order to obtain full information regarding the possibilities of the route. Similar work will be carried out in Hudson Bay itself, where the prospects of Port Nelson, at the mouth of the Saskatchewan River, and Fort Churchill, 90 miles further north, will be carefully compared with a view to discovering which of these ports remains open and free from ice for the longer period. The water inshore is deeper at Fort Churchill and this may be the deciding factor.

This will be one of the most difficult and extensive flying expeditions ever undertaken and its results are awaited with keen interest. Some idea of the importance of the scheme to the farming community of the Canadian Middle West may be gathered from the fact that more than a million dollars are being spent in exploring the possibilities.

Australians to become More Primitive !

The influence of new surroundings on the physical character of human beings is a subject on which very little is known, because any changes produced in this manner must come about slowly. But some students of the subject have suggested that the fusion of the many types of people that have contributed to the settlement of North America will in time produce a race more like the North American Indians than any European people. It is said that traces of this change have already been detected.

An even more astonishing argument has been put forward by a well-known anthropologist in regard to Northern Australia. The climate there is tropical, and the humidity resulting from the high temperature dilutes the atmosphere so much that a human being from temperate climates has difficulty in obtaining sufficient oxygen. The result of living in such a climate will eventually be the development of larger lungs. Furthermore, a shorter route from the outer air to the lungs will also be necessary, and this can only be attained by a change in the shape of the nose, the long elevated nose characteristic of Europeans being replaced by a flat, saddle-shaped nose with wide nostrils. Ultimately the country will be inhabited by individuals with dark skin, black hair and features, to which a flat nose will give the character usually described at present as "primitive"!

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World's Largest Springs

In this country a spring is not usually regarded as a copious source of water and it is not often that one is found with such a flow that it is capable by itself of supplying the water requirements of a large city. This is the case with several springs in America, however. In Florida, for instance, there is a limestone spring that yields 6,149 gallons of water every second, or enough to supply a city the size of London! The water from this spring is perfectly clear and on the lake into which it flows are glass-bottomed boats to enable visitors to see the fish and plants that grow in it.

Another interesting spring is found in Idaho. It gushes from the walls of a canyon on the Snake River in a thousand branches, forming a waterfall 200 ft. in height and nearly half a mile in length. As a spectacle this is now spoiled to a large extent, as the daily flow of 561,000,000 gallons of water is used for power production. In comparison with these amazingly productive springs those found in Great Britain are quite insignificant, although many have contributed to the water supplies of large towns.

Uses of Dynamite

The article on "*Killing Fish with Dynamite*" that appeared in the July "*M.M.*" is a reminder that the same method is used for catching sharks by a firm interested in the shark-leather business, while whalers now use a lance with a small quantity of high explosive in the tip. Other strange uses that have been made of dynamite include the removal of nuts and bolts from tight places in machinery, clearing snow from mountain passes and causing dry wells to produce oil.

Remarkable use has been made of dynamite in dealing with rivers. Pueblo, the principal city of Colorado, was threatened with destruction on one occasion by a sudden rise in the level of the Arkansas River, which flows through its centre. The city was flooded to a depth of 14 ft. and enormous quantities of rocks, logs and other debris brought down by the swift rushing current were piled on top of each other. The obstruction caused the water to spread farther into the country, but sticks of dynamite thrown into the "jam" and detonated electrically broke up the piles and released the water. Subsequently the explosive was used in cutting a deeper channel through the city to avoid a repetition of the floods.

A somewhat similar use of dynamite was made at New Orleans, which was saved from disaster in the recent Mississippi floods by blowing up a portion of the embankment below the city that retained the water.

When the gorge below Niagara Falls was choked up by huge masses of ice, the explosion of a ton of dynamite broke up the jam.

In constructing the Panama Canal 56,000,000 lb. of dynamite were used during the excavation of the great Culebra Cut, and the total depth of the holes drilled to receive this dynamite was practically three times the diameter of the earth.

Even ice cream is cheaper than it would otherwise be because of the use made of dynamite in blasting out the rock salt for freezing it!

* * * *

New Star of Unusual Size

A new star of great interest has recently been detected on photographs of a region of the sky in the constellation Leo. It is an exceedingly faint object but is chiefly of interest because of its size, for it is believed to be only 25,000 miles in diameter. For a star this is unusually small but in compensation it is amazingly heavy. Its density is so great that although only three times the size of the earth it is more than 300 times heavier.

The Greatest Bird Traveller

Undoubtedly the most travelled bird in the world is the Arctic tern, a white feathered bird with a black cap and a forked tail. The tern builds his nest on the shores of the islands to the north of America, as near the Pole as possible, and he remains in that neighbourhood for the Arctic summer. When the long winter night approaches he flies south, as do other birds, but he is not content on attaining a warmer climate, for he flies on and on until at length he reaches the Antarctic continent, where he finds a climate and season exactly like the one he has left.

This journey of 11,000 miles is repeated in the reverse direction at the end of the Antarctic summer. Why the bird should travel 22,000 miles in a year is not known, nor have we discovered by what route he flies. One thing that he does achieve by this long journey is to become the record holder among living creatures for the hours of daylight that are seen in the course of a year. He lives within the Arctic Circle during the months when the Sun never sets there, and spends four months in the Antarctic Circle under precisely similar circumstances!

The whole subject of bird migration is very mysterious. Other examples besides the one already noted show that it is not merely the need for a warmer climate that influences the birds to fly south in autumn. The golden plover, for instance, leaves his summer home in the far north and passes through or over the forests of Brazil and other tropical countries before finally coming to rest in the wild and desolate country of Patagonia. There he rests two or three months before returning to his home, 8,000 miles away. Many birds from our own temperate climate migrate to South Africa, while the storks of Central Europe seem to fly no farther south than Egypt and Kenya. The wanderings of birds have been traced in part by marking and then liberating captives, but comparatively little is known as yet, particularly with regard to the causes of the annual migration.

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Boring Worms and Beetles

Readers of the articles on Sir Charles Bright that appeared recently in our "*Famous Engineers*" series will remember the trouble experienced with the teredo during cable-laying in the Persian Gulf. This little worm bores its way easily through wood and is responsible for an enormous amount of damage to ship's timbers and wooden jetties. The method adopted by Bright to prevent the worm from destroying his telegraph cables was to mix calcined flint with the material used for the outer cover.

The builders of the Carquinez Bridge in the San Francisco Bay region experienced similar trouble and overcame it by a novel method. It was necessary to build cofferdams, and the teredos had caused one group of piles to collapse in a few weeks. The engineer then built a waterproof false wall around the timber and filled the intervening space with a solution of blue vitriol, or copper sulphate, to poison any teredos that harboured designs on the timbers of the cofferdam. The remedy was effective, but unfortunately it is not one that can be adopted widely.

Trouble is also experienced ashore from creatures that bore tunnels, and the illustration on this page shows the depredations of one of them. The individual concerned is a black beetle known to forestry experts as *Scolytus destructor*. It is a very tiny one, not nearly so long as its name, for it measures less than a quarter of an inch. It enters the trunk or large branch of an elm tree by a tiny hole that would scarcely be visible if it were not for the presence of

The ravages of the scolytus, a beetle that bores under the bark of elm trees

the fine dust that the beetle throws out behind, and then tunnels its way between the bark and the wood. There is some resemblance between its work and that of the teredo, but the latter drives tunnels through the length and breadth of the pieces of wood that it enters.

Once inside, the beetle lays eggs in the tunnel itself or in niches specially constructed for this purpose. Then the larvæ emerge, wrinkled, legless grubs with brown heads and strong jaws, which grow up into adult beetles in three months. In the meantime the beautiful system of tunnels illustrated is bored out with great perseverance. The cross-section of the tunnels is oval and of sufficient size to accommodate the larvæ in comfort. It is noteworthy that these remarkable engineers even construct ventilating holes!

The presence of an insect such as this, boring its way through the bark and sapwood, is not good for the elm tree, and to make matters worse two generations of the beetles are produced every year. The first eggs are laid in April and May and the adults appear in July and August, but the second generation of larvæ winter in the tunnels and only come to maturity in the following April. Thus an infected tree is really never free from the pests, which are in full activity throughout the whole of the tree's growing period.

There are many varieties of bark beetles, as they are called, none of them much longer than a quarter of an inch and some of them as small as one-sixteenth of an inch. Other special types attach themselves to oak, birch and fruit trees, while the beetles that invade fir trees are specially destructive. They are most prevalent in woods and forests, where brushwood is allowed to accumulate around the base of the trees and foresters trap them in stumps and logs placed in attractive positions. They have natural enemies, which might be encouraged in order to bring about their disappearance, but this method of destroying insect pests is not favoured so much in Great Britain as it is in the United States and Australasia.

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Climatic Contrasts in Asia

Asia is the largest and most "continental" of continents. It spreads from the Arctic Ocean to the equator and thus exhibits an enormous range of temperature and other conditions. In addition, certain places in its interior show great extremes in climate, partly because of their distance from the sea and partly because of the presence of enormous mountain ranges forming climatic barriers. For instance, the mean range of temperature at Verkhoyansk in Siberia is almost 180°F., ranging from 97°F. below zero to 80°F. above, the best example of a continental climate that can be found. In Ceylon, on the other hand, the proximity of the sea has made the climate so equable that the highest temperature rarely exceeds the lowest by 50°F.

At a place named Jakutsk, also in Siberia, the bore of a well sunk to a depth of 363 ft. did not reach unfrozen earth, while at the same time of the year the average temperature in Southern India is nearly 80°F., the Himalayas interposing a vast barrier to the cold winds from the north. Another instance of the sheltering effect of mountains is seen on comparing the average temperatures of Calcutta, in India, and Canton, in China, two cities in the same latitude. In general Calcutta is 15° warmer than Canton. Similarly Shanghai is at least 18° colder in winter than Lahore. China is exposed to cold north-east winds from the elevated deserts in the interior of Asia, and is thus colder generally than sheltered India.

Rainfall in Asia presents equally striking differences. In the deserts of Arabia there are spots where rain rarely falls and there are also considerable areas in Central Asia where no rain falls at all for three or four years at a time. But in the Khasi Hills of Assam, just south of the Himalayas, no less than 500 in. of rain fall annually, and as much rain may fall there in one day as London receives in an average year!

* * * *

World's Insect Population

No fewer than 640,000 different kinds of insects are known and several thousand new varieties are discovered every year. The numbers of the insects themselves is astounding. In Cyprus in 1881 grasshoppers were so numerous that the destruction of millions of egg cases, weighing 1,300 tons, had no visible effect on their number.

Motoring Over Snow

Ingenious Adaptation of Fordson Tractor

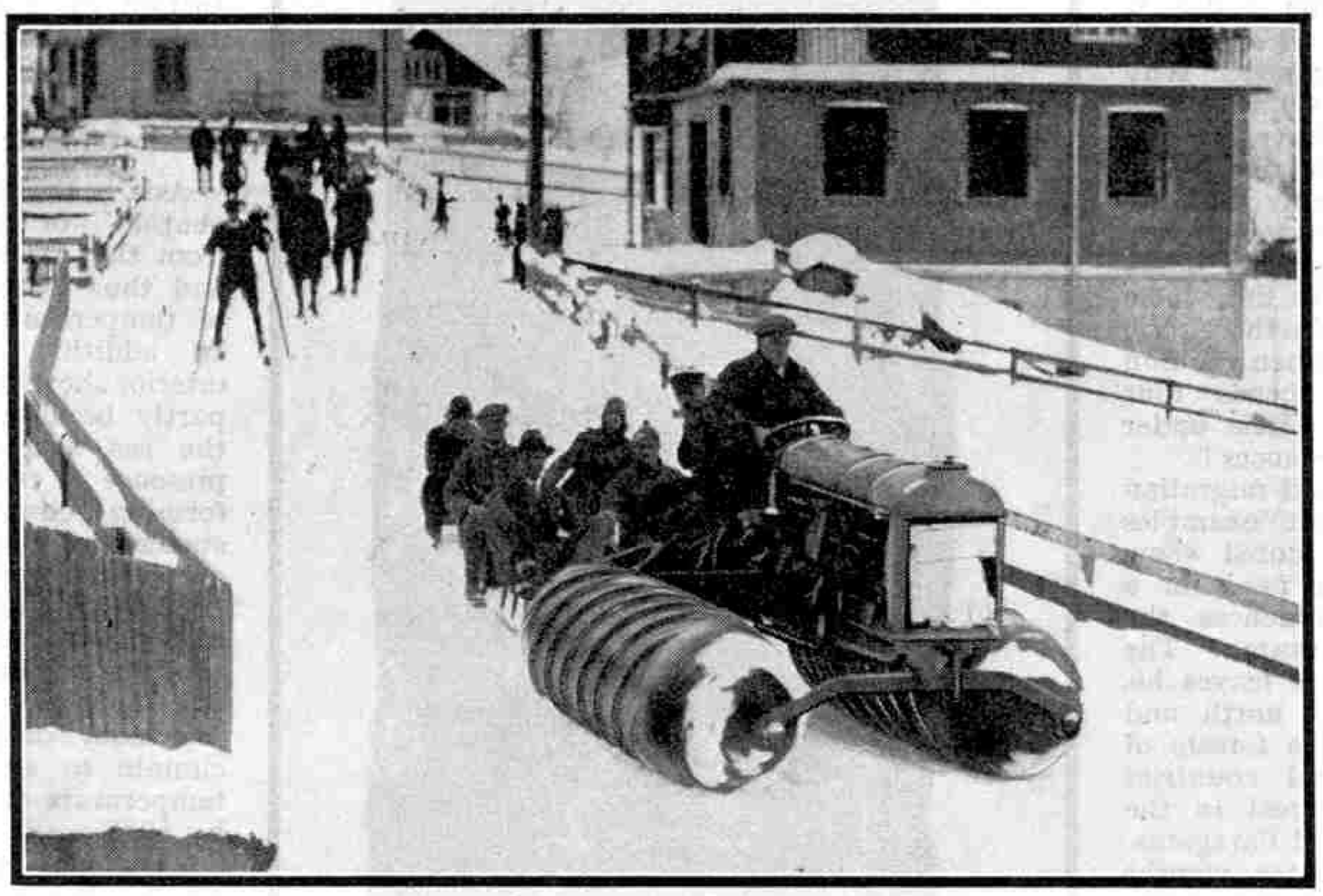
By G. W. Greenland

THE sensational discovery early in 1926 of rich gold deposits near Red Lake, Northern Ontario, when veins up to 20 ft. in width were found, drew attention to the enormous difference between the conditions attending a gold rush to-day and those obtaining even as recently as 1897, the date of the Klondike discovery. Motors and even aeroplanes were used in Ontario, and among the vehicles that proved serviceable and efficient in transporting the prospectors and their baggage to the scene of operations was a new "snow motor."

The severest weather of a British winter, when our roads are ice-bound for a brief period, gives but a feeble idea of the difficulties of snow travel without special equipment. The problem to be solved is not insufficient power, but inability of the wheels to transmit this power to the glassy surfaces. Fortunately we experience such conditions very rarely, but in territories where snow and ice lie on the ground for several months of each year the introduction of a suitable vehicle for travel in such conditions is a matter of vital importance.

America and Canada have used lumber trains for very many years to haul wood from the frozen forests. A special kind of steam locomotive is fitted with a caterpillar track instead of driving wheels and is steered by a sledge in place of a bogie, a hand wheel something like that of a motor-car being used. Water is sluiced over the tracks to be used for hauling, and when it has frozen the ice locomotive puffs along with its train of lumber-laden sledges. With the advent of the petrol vehicle an improved motor-caterpillar was introduced, but never came into use to any great extent. Sledges also have been fitted with aerial propellers driven by motors, but this produces a light, high-speed machine entirely unsuitable for the transport of heavy goods.

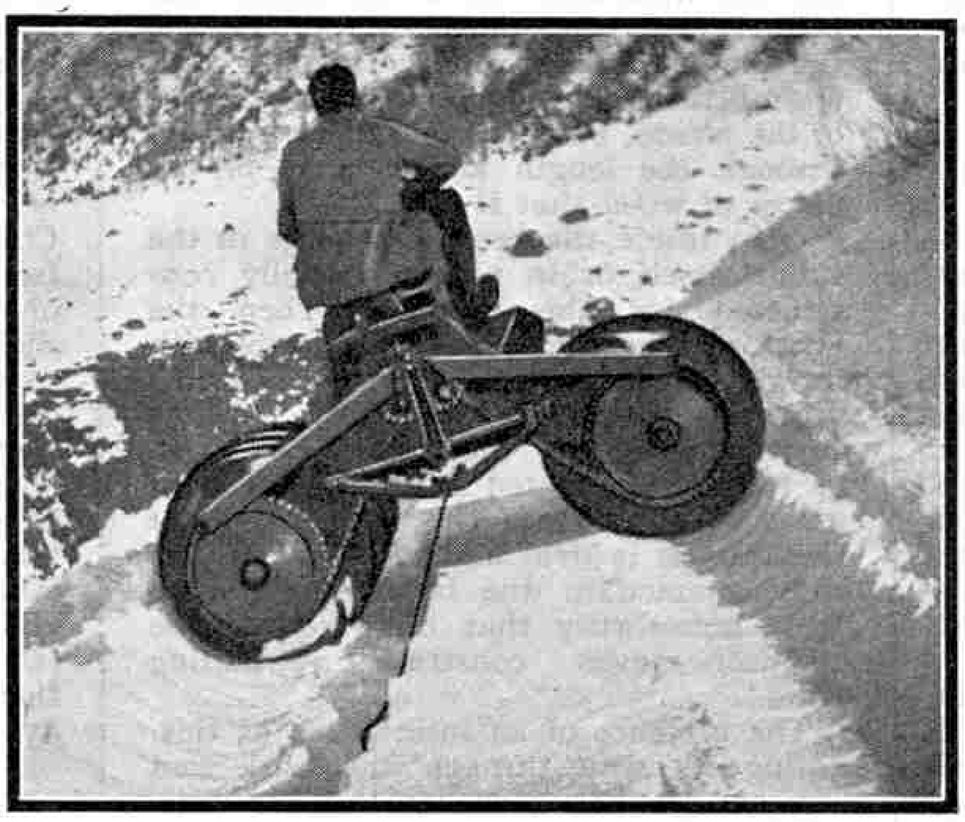
The various difficulties appear to have been overcome in a new snow-motor, an American product. This vehicle is a veritable landship for it is propelled by two screws in a similar manner to an ocean liner.



[Courtesy] [Messrs. Snow-Motors

Visitors to Switzerland find the snow-motor useful

The Fordson tractor is used as the basis of the vehicle. In place of the normal back axle is bolted a cross-frame, the arms of which jut out on each side and terminate in bearings. These bearings lie fore and aft. Underneath the radiator is a kind of front axle, also finishing in fore and aft bearings aligned with those at the back. There is thus a pair of these bearings on each side of the motor. Working in each pair is a long steel drum, nosed in front like a shell, and some two or three feet in diameter. These drums are parallel to the engine crank-shaft and are as long as the whole machine, which stands upon them as a car stands on its wheels.



Courtesy] [Messrs. Snow-Motors

Rear view of the snow-motor

Round each drum winds a hard steel flange, curving spirally for its whole length, and each is driven by chain and sprocket from the engine. When the ice drums are sunk by the weight of the vehicle to about a quarter of their depth in snow there still remains a good clearance beneath the chassis. The drive is transmitted through clutches, and as the spirals run in opposite directions the circumference of each drum is moving outward where it is in contact with the snow on which it is travelling.

The general appearance of this ingenious adaptation of the Fordson tractor is well conveyed by the accompanying illustrations. The chain drive to the great

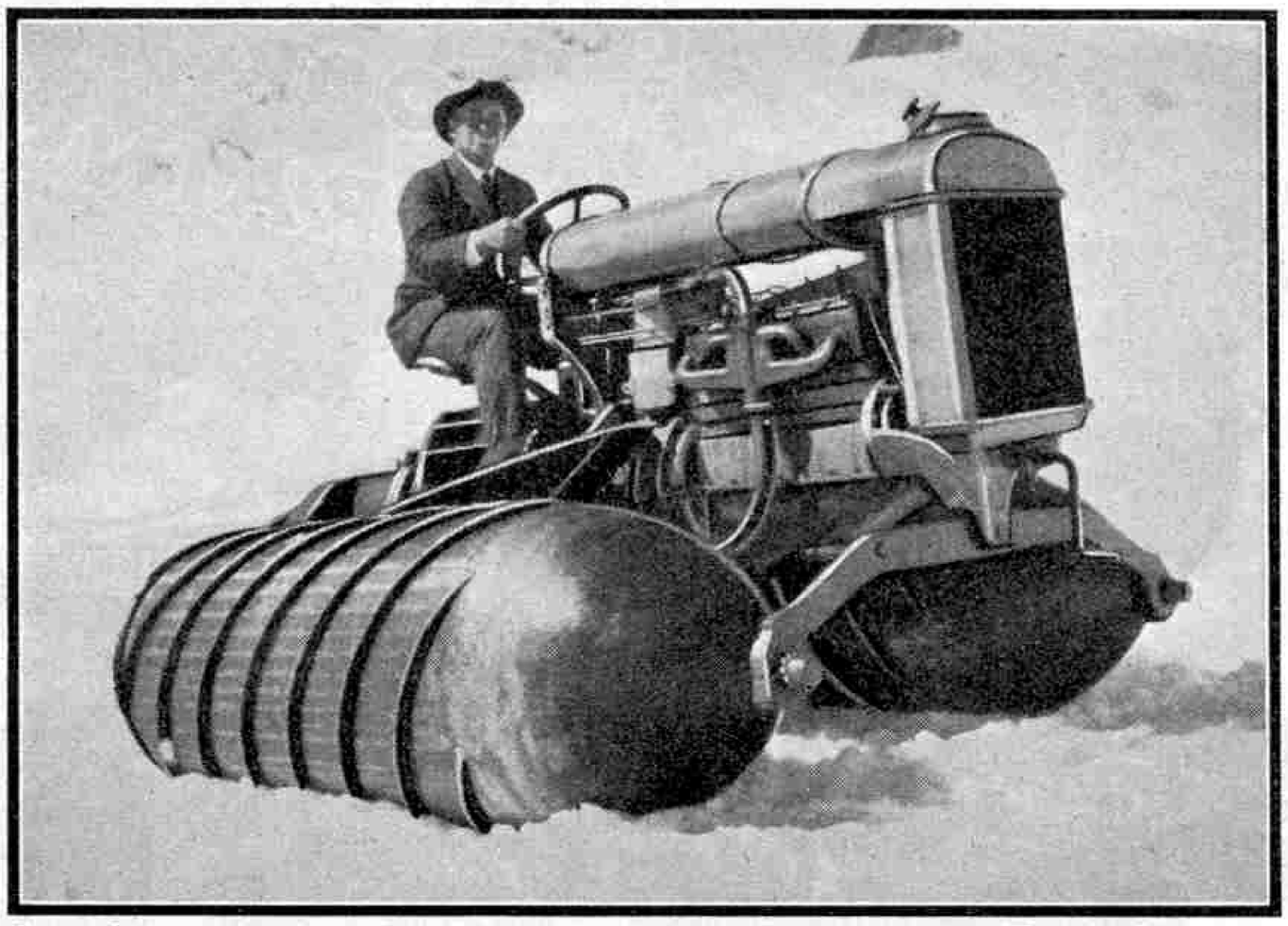
drums is seen very well in the stern view, which also gives a fine idea of the relative sizes of the drums as compared with the driver.

The other illustrations give a good idea of the spiral threads on the drums and of the rocking transverse support, carrying the weight of the vehicle, that connects the front ends of the drums. The rear transmission case that replaces the back axle of the normally fitted Fordson tractor is also visible under the driver's seat. It will be seen that the chassis is arranged on the three-point suspension system, making it ideal for negotiating rough ground.

When running normally the drums turn at equal speeds, and their screw flanges screw the vehicle forward, its weight enabling the drums to get a good grip on the snow. Steering is effected by altering the speed by means of the clutches. Thus if the right-hand drum is slowed down the vehicle bears round to that side, and vice versa. Similarly, if either drum be declutched absolutely, the vehicle spins round to the side concerned, turning on its own axis. The pointed drum noses press the snow down hard and prepare it for the coming drum surfaces, which bear all the weight.

The clutches which, as previously explained, allow the drums to rotate at different speeds for steering, are connected up directly with the usual steering gear, which is seen in use. It is an interesting point that brakes have been found quite unnecessary in actual use. Once the power has been cut off by the driver there is no tendency for the drums to over-run, as is the case with the wheels of an ordinary vehicle.

The use and advantages of the snow-motor are legion. It can negotiate snow of any depth and, as is seen in one illustration, it leaves behind it a well beaten track. This track, being of the same width as the gauge of ordinary motor vehicles, is very valuable for enabling them to follow in the wake of the pioneer machine. It may be used in fact as an invaluable road-maker after a heavy fall of snow.



Courtesy] [*Messrs. Snow-Motors*

The snow-motor at work. The spirals on the drums are well seen in this photograph

Remarkable powers were revealed in some very thorough tests. For instance, a snow drift in which horses had floundered helplessly was literally eaten up by the newcomer at a speed of no less than 12 miles an hour. It also took fences the tops of which protruded above the surface of great drifts. Huge sleds laden with 20-ton loads of lumber were hauled with the most complete success both on glassy ice and through tough brushwood. Strangely enough the machine will also work very well on thick grass, and can also travel on bare ground.

In order to carry out a specially searching test one of these snow-motors was taken by train to the Jungfraujoch, the terminus of the railway up the great Swiss mountain, the Jungfrau. There in the snow, at a height of 11,340 ft., it gave an amazing exhibition of its powers. With the engine throbbing and the exhaust crackling in the rarified atmosphere the craft cruised about, reversed, swung round, spun this way and that, and climbed up and down in perfect accord with the intentions of its driver. The onlookers were greatly impressed and little doubt was left in their minds of the usefulness of the invention under these conditions.

There is no doubt that these snow-ships will play a great part in developing traffic in ice-bound regions. Industries that hitherto have shut down with the annual freezing will be able to continue all the year round with their aid. They may prove of value for Arctic and Antarctic exploration, but the substitution of air cooling may be necessary for these purposes.

Already the snow-motor has one conquest to its credit, that of the terrible MacKenzie Pass. This pass, situated north of the Yukon and Klondike, is known the world over for the grimness of its character, and is utterly impassable by any ordinary means in winter. It has now been vanquished by the snow-motor, which, hauling a massive sledge fitted with a stout bus-like body seating 14 passengers, is now running a regular service.

America's Wonderful Indoor Sports Arena

The old Madison Square Garden, New York, U.S.A., long famous in the annals of the sawdust ring, the horse show, six day bicycle races, and various spectacular athletic events, has passed out of existence. Its successor, the new Madison Square Garden, occupying a different site, is America's largest indoor arena. It will hold 35,000 persons when both floors are used, the upper level alone seating 18,000.

In the building of this gigantic structure, a number of entirely new problems were encountered and solved. Hockey is the main sport at the Garden during the season, and a method of providing suitable ice surface was one that had to be dealt with. To solve this, over 12 miles of pipe were embedded in the polished terazzo floor of the arena, and the largest brine machines ever built were installed. The result is a hockey rink that can be sure of perfect ice regardless of time or weather.

Another of the problems given particular thought by the owners of the building, was that of eliminating the dense blue haze of tobacco smoke so familiar to habitues of the old Garden. No ventilating plan on so huge a scale had ever before been attempted, and many were sceptical as to its possibility. Yet the owners now consider the system installed a complete success. This ventilating system consists of an elaborate system of filters, air washers, and fans, driven by 300 h.p. General Electric motors and equipped with complete auxiliary equipment.

Another feature of the ventilating system is the ozoning equipment, which purifies the air still further by injecting ozone into it.

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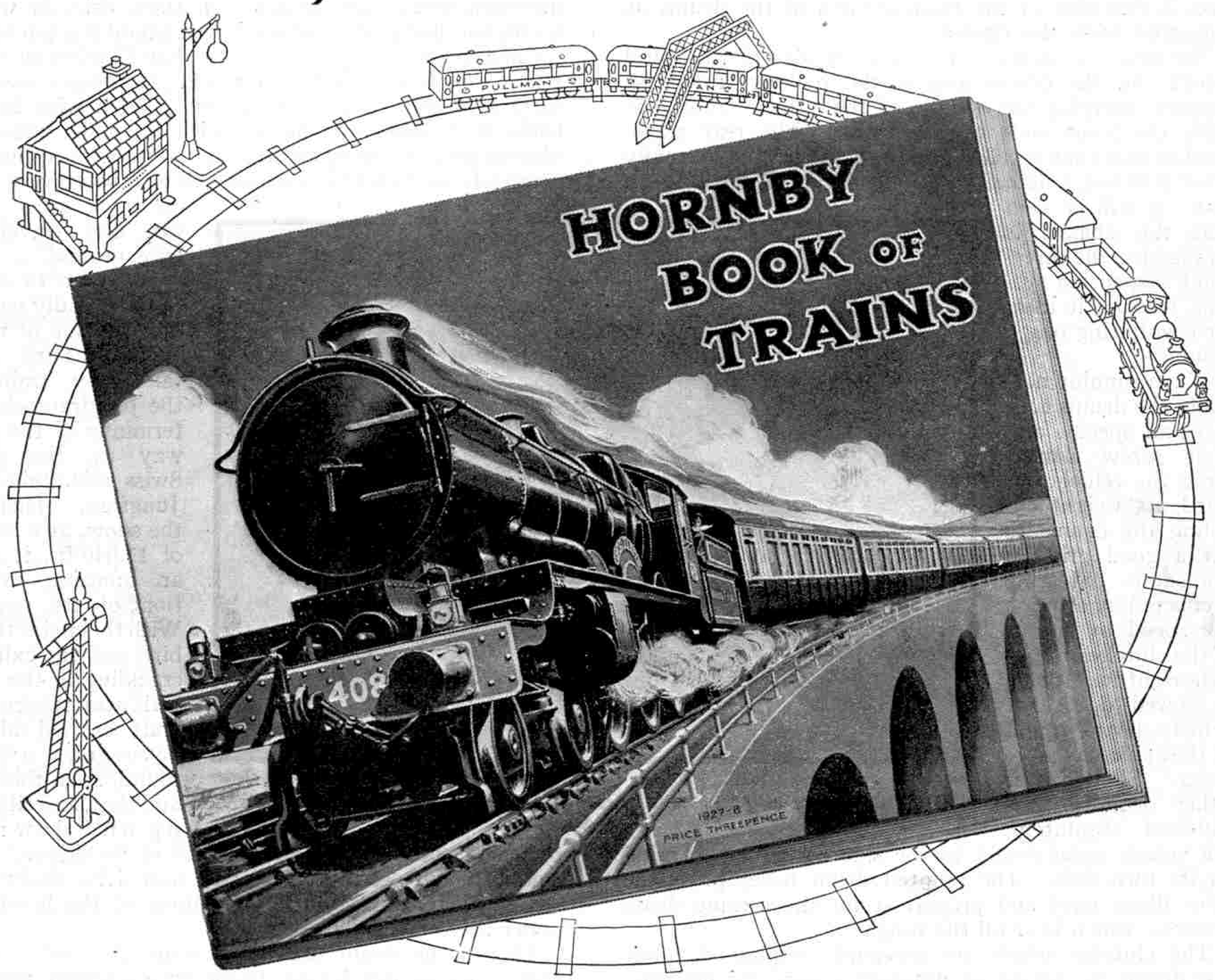

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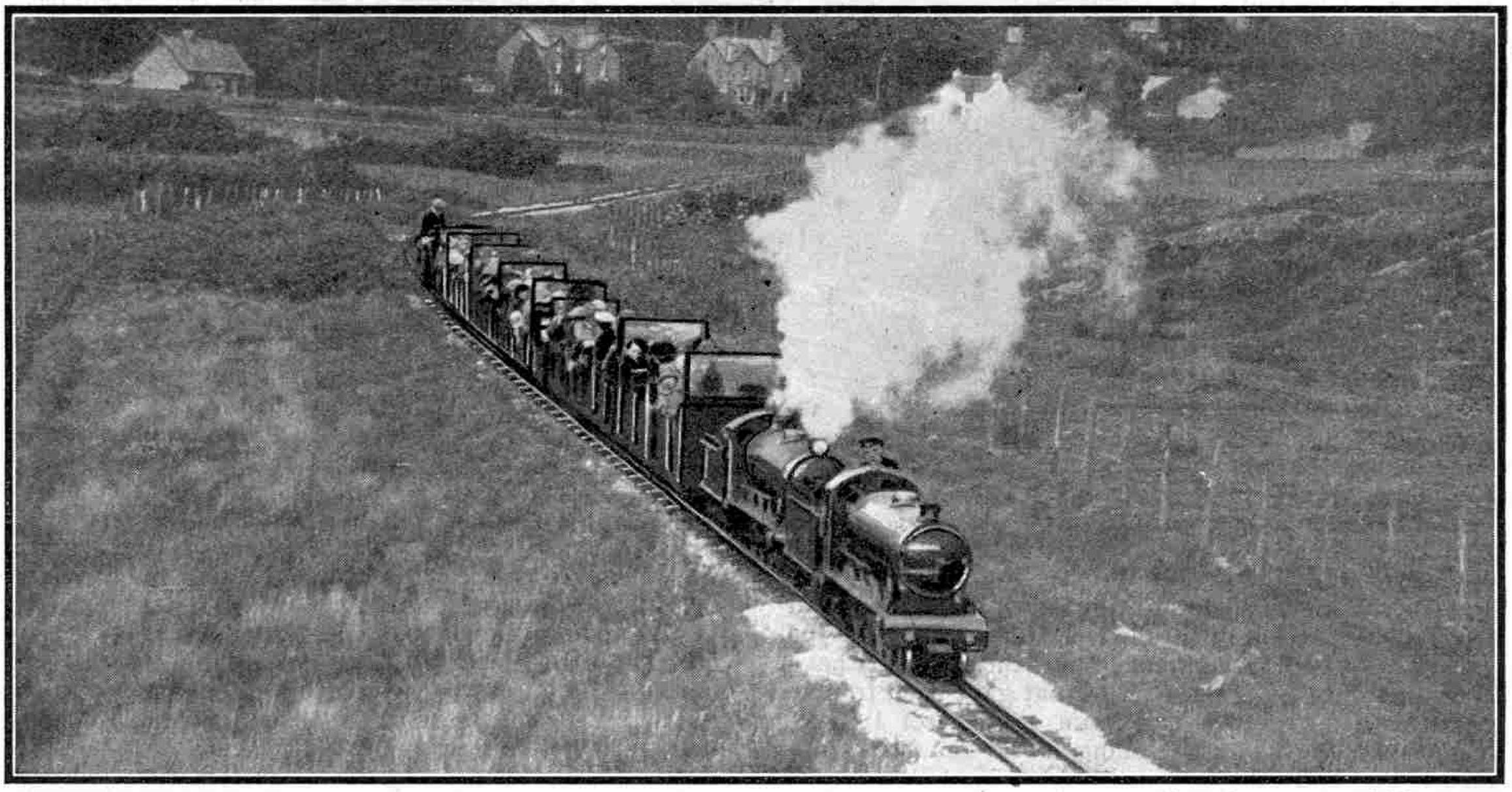
Miniature Railway Earns its Living

By Cecil J. Allen, M.Inst. T., etc.

(Photographs by Miss Mary C. Fair, Eskdale)



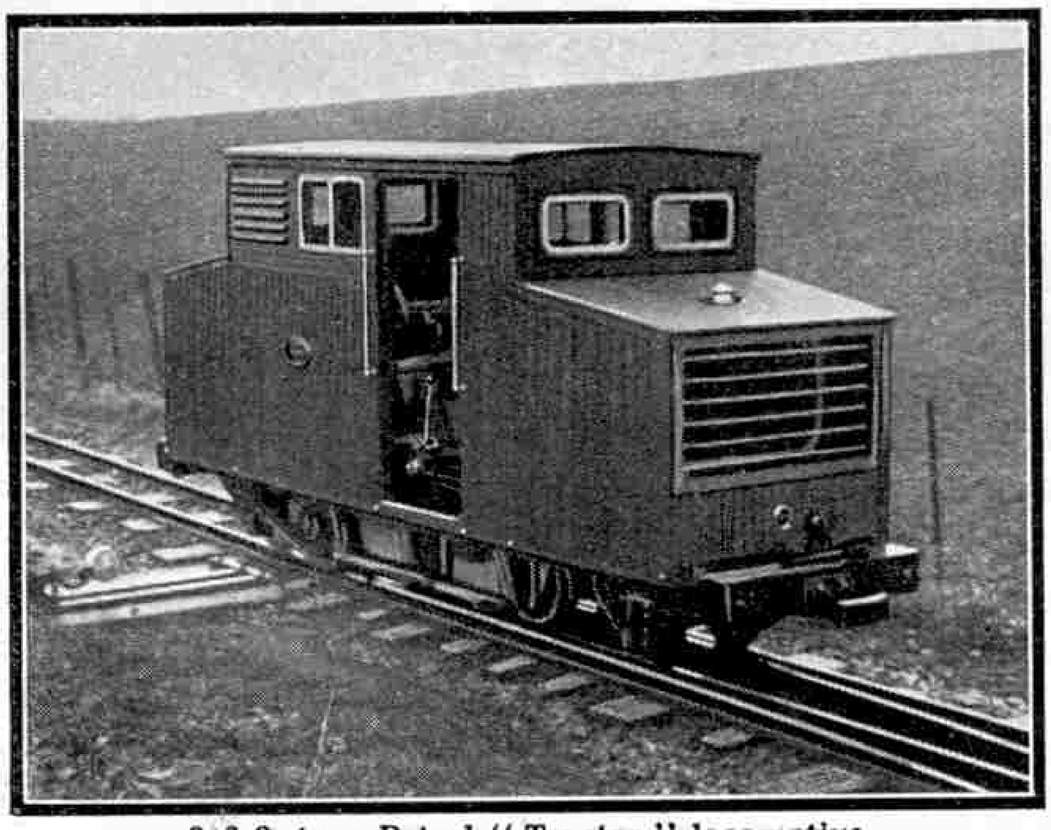
An "Express" Train at full speed near Irton Road, headed by two "Pacific" locomotives. These trains often consist of 15 coaches and carry 120 passengers

IF you have never yet seen the railway that runs from Ravenglass, on the west coast of Cumberland, up into Eskdale, your education in railway matters is incomplete. The Festiniog and other of the narrow-gauge railways of North Wales have often been referred to as "toy" railways, although they work on a gauge of 1 ft. 11½ in. The Eskdale line goes one smaller, however, by electing to run on a gauge of 1 ft. 3 in.

Before the railway assumed its present form, it had a precarious existence as a line planned to carry iron ore down from Upper Eskdale to the coast at Ravenglass. It was opened in 1876, the original gauge being 2 ft. 9 in. A few years later, however, the price of iron ore dropped so much that the mining in Eskdale became no longer profitable, and the little railway was left practically without traffic. For a long time it dragged on wearily, carrying passengers in the summer up to one of the loveliest districts of Cumberland, but early in the present century it closed down altogether.

Then there came along a group of people who had for a considerable time been running 15-inch gauge railways at exhibitions and seaside places, with scale model locomotives as the chief attractions, and they determined that they would turn the Eskdale line into a "Scenic Railway" of the very first order. So the old overgrown track was cleared, the rails were lifted and re-spiked down only 15 inches apart, and two fine scale model engines, one an "Atlantic" and the other a "Pacific," were brought up, with a quantity of passenger rolling stock, to start the service.

This was in 1916, and since then the fame of the Ravenglass and Eskdale Railway has spread far and wide. The novelty of travelling in little open cars seating two a side, or in diminutive covered passenger carriages whose three compartments could only hold twelve—and then at the risk of bumping their



2-6-2 type Petrol "Tractor" locomotive

The six-coupled chassis of a 0-6-0 tank locomotive has been utilised in the construction

heads on the roof should they sit too erect!—was such as to bring holidaymakers from all directions. Railway communication, too, gave a new lease of life to the valley.

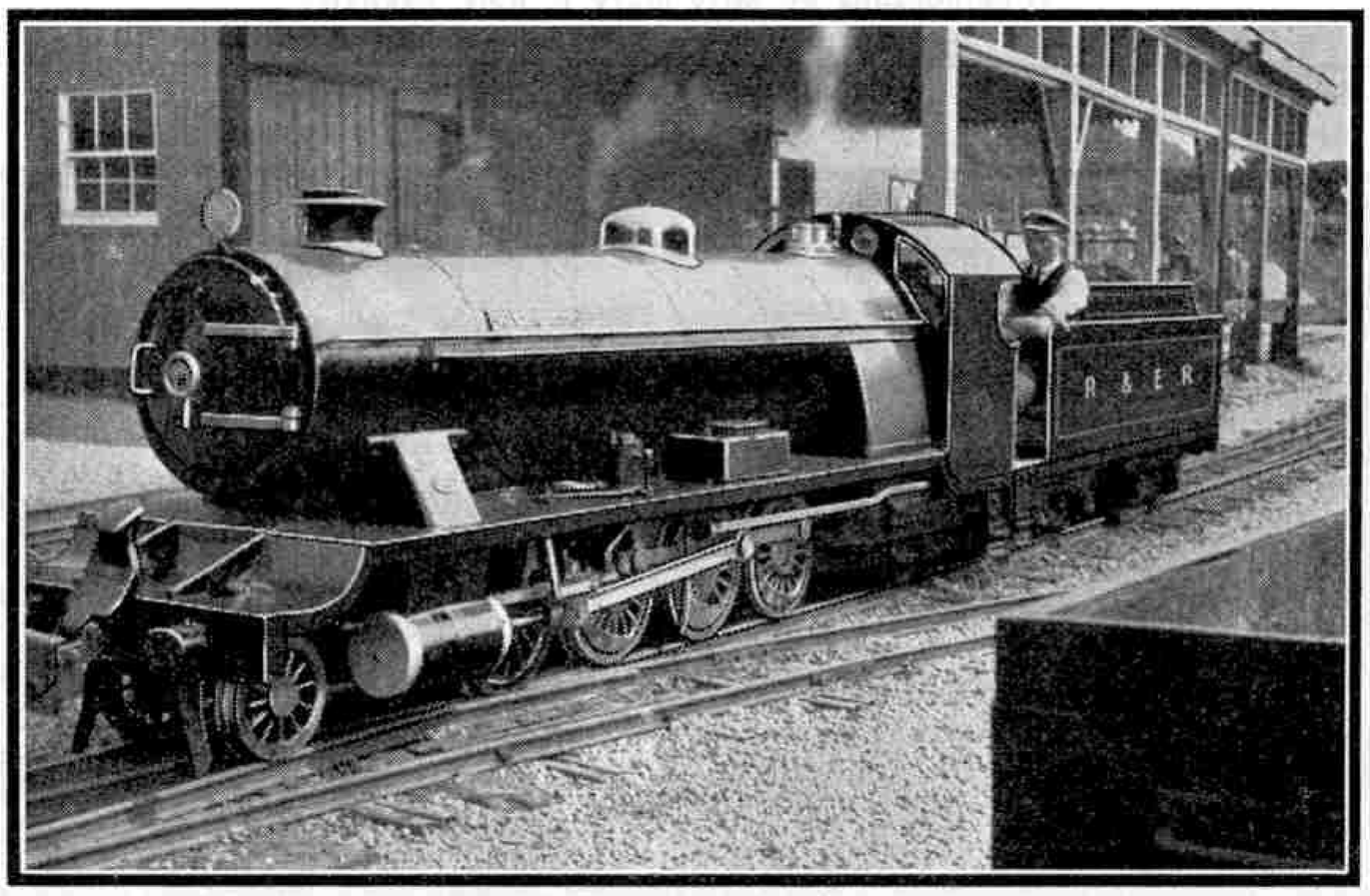
There were drawbacks, however. The scale model engines, accustomed to short runs on level tracks in the grounds of exhibitions, found a seven-mile journey over a more or less rough road up into the mountains a different proposition altogether. Gradients as steep in one place as 1 in 33 caused frequent "stalling" with heavy loads. The construction of the engines also was too light to stand up to the heavy day-to-day work, and failures were not infrequent.

Since the early years of reopening a vast amount of reconstruction work has been done, however, and under the enthusiastic efforts of Mr. W. Gillon, the present General Manager, and Mr. E. H. Wright, the Engineer, the Ravenglass and Eskdale Railway is prospering as it had never done previously in all its history. Many of the curves have been straightened out; the gradients have been smoothed until the 1 in 33 that gave such trouble has been reduced to a maximum gradient of 1 in 94 along this length; new rolling stock has been constructed; and the internal combustion engine has been pressed into service for tractive purposes, along with the steam locomotives.

One development that has brought about a great change in the fortunes of the line has been the opening of a stone quarry near the top end, at Beckfoot, and the installation of a big stone-breaking plant on the side of Muncaster Fell. The large pieces of stone from the quarry are brought down a distance of three miles from the quarry to the plant, and the broken stone is then hauled over the remaining three miles to Ravenglass, where hopper wagons drop it straight off a raised viaduct into the L.M.S. standard gauge wagons underneath. For this traffic the Eskdale line has had built six beautiful all-steel hopper wagons, carried on bogies, the capacity of each of which is no less than six tons of stone—on a 15-inch gauge! Each hopper wagon weighs 2½ tons. Altogether there are 80 four-wheeled wagons, 60 being of all-steel construction.

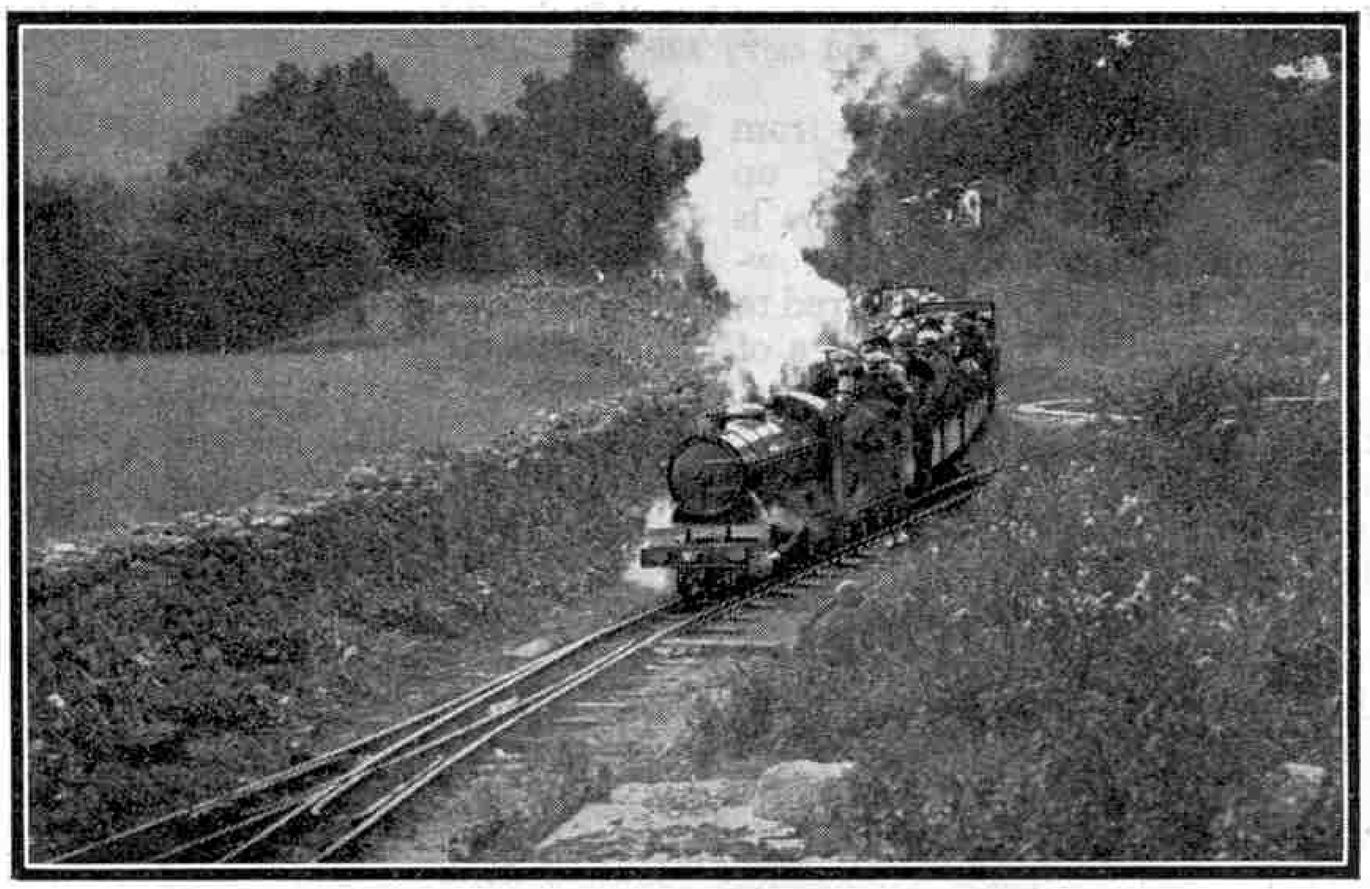
The stone traffic is all worked by petrol-driven locomotives. One of the locomotives is particularly interesting, because the middle part of it consists of a six-coupled *chassis* of the old tank engine "*Ella*," which at one time worked over the line. This six-coupled *chassis* has been fitted with radial axles fore and aft, turning it into the 2-6-2 wheel arrangement, and it is now driven by a 38-h.p. Lanchester motor. The tractor is capable of handling a 38-ton load on the level at 15 miles an hour.

There is also a 22-h.p. "Fordson" tractor, and the engine of a real "Tin Lizzie" has been fitted into a very neat double-bogie car, with sloped ends like an electric engine, making the handiest of units for reserve passenger work. The latter is a very speedy machine, too; the writer has travelled at 36 miles an hour behind her, and has timed the seven miles of the line to be covered in 15½ minutes. When the passenger is so near to the ground as in these little cars, such speeds seem quite terrifyingly fast! But the customary journey time, including all stops, is from 35 to 40 minutes.



2-8-2 passenger locomotive "*River Esk*" at Ravenglass

This engine is shortly to be rebuilt in accordance with the Poultney patent as an articulated 2-8-2—0-8-0 locomotive



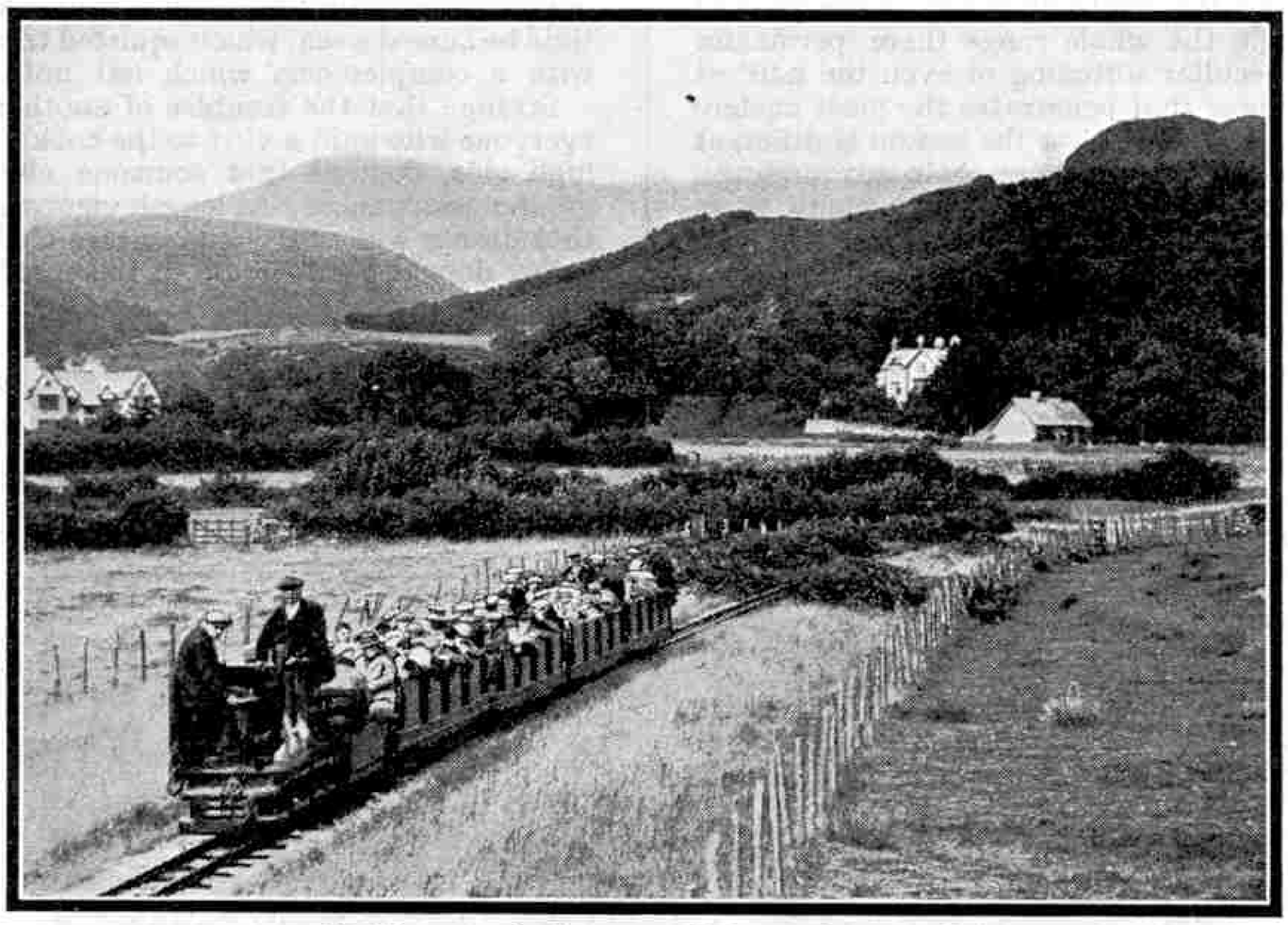
The "*River Esk*" approaching Dalegarth terminus. A heavy load of nearly 200 happy holidaymakers

Two passenger trains each way a day are sufficient for winter needs, and as the "attraction" of the scale model engines is not needed in wintertime, the converted "Ford" is responsible for the passenger work. In summertime, however, five passenger trains are required each way daily, with extra trains on Wednesdays and Saturdays, and often three steam engines are in use. On Bank Holidays every available passenger vehicle is pressed into service and is filled to overflowing. Some idea of the extent of the traffic will be obtained when it is mentioned that last Whitsun Monday the Ravenglass and Eskdale Railway handled no less than 1,200 passenger single journeys!

For passenger-carrying there are 12 bogie cars,

both open and closed, seating 16 passengers each, and 18 open 4-wheeled cars seating eight each, giving a total seating capacity of 336 people.

Chief interest, of course, centres in the steam locomotives, of which there are four. "*Sanspareil*," the 4–4–2 engine, not being up to the heaviest duties, is kept as a kind of stand-by. Then there are two 4–6–2 engines, "*Colossus*," with a bogie tender, and "*Sir Aubrey Brocklebank*," with a tender on six wheels. The illustration on page 1069 shows both of them at work on a holiday "express." But by far the most powerful of the steam engines is the 2–8–2 "*River Esk*," which is shown opposite. This locomotive is readily capable of handling a train of 200 passengers, and has done so on a number of occasions. It will be noticed that the driver of this engine sits at a lower level than do the drivers of the "Pacifics"; and the "*River Esk*," too, is provided with a sliding roof to the cab, which affords the driver complete protection, when necessary, from the weather. This is a considerate precaution, as when it rains in Eskdale it really *does* rain!



Holiday work for one of the "Tractors"

Showing some of the beautiful scenery en route. The view is taken near Irton Road, and cloud-capped Scafell is seen in the background. There are 70 passengers on the train

This autumn "*River Esk*" is to undergo a highly interesting transformation. Her builders fitted her with Lentz "poppet" valves, which on so small a scale as this have occasioned a good deal of trouble in the matter of maintenance. So "*River Esk*" is going away to the Yorkshire Engine Company, who are going to rebuild her in accordance with the Poultney patent, which was described in detail in the January issue of the "*M.M.*" The four tender axles are to be coupled together and driven by two cylinders, and the engine will therefore be articulated, with the 2–8–2+0–8–0 wheel arrangement. Another rebuilding now under way is of the old 0–8–0 tank engine "*Muriel*." The boiler has been taken off her and—a sad end, indeed—has been mounted on a trolley and sent up to the quarry to provide steam for the drills! But the 0–8–0 *chassis* is to be converted to 0–8–2 and fitted with a scale model type boiler and a tender, when the rebuilt "*Muriel*" will take her place among the steam passenger locomotives.

The Ravenglass and Eskdale Railway gives access to the lesser-known side of the mountains of the English Lake District, and it brings some fine scenery within easy reach. Dalegarth, the upper terminus of the line, is at the foot of Scafell, which, with its 3,210 ft. of altitude, is the highest English mountain. Wastwater, the deepest English Lake, is brought nearer by the little Eskdale line than by any other rail communication, and may one day be actually connected by a branch from Murthwaite. "*M.M.*" readers staying on Windermere, Grasmere or Coniston Lakes will find the simplest way of getting into Eskdale—even if a somewhat energetic one—to be the walk over the old Roman Road, by Wrynose and Hardknott Passes, from Langdale. But, by whatever route you travel, do not fail, when next you are in Cumberland, to pay a visit to what is in many respects the most interesting railway in the country, not only by reason of its equipment, but also because of the varied scenery through which the line passes.

Forty-one 2,600 h.p. Electric Locomotives for India

One of the largest contracts ever made for electric locomotives has been placed by the Great Indian Peninsula Railway with the Metropolitan-Vickers Electrical Company. The contract comprises forty-one locomotives of a size and power greater than any hitherto built in Great Britain and amounts in value to well over six hundred thousand pounds.

The new locomotives are for hauling heavy freight trains on the main lines from Bombay to Igatpuri and to Poona. Both lines go over the Ghat mountains, where gradients as heavy as 1 in 40 and 1 in 38 are regularly encountered. Each locomotive will weigh 115 tons and will be equipped with motors totalling 2,600 h.p. The locomotives are for single unit operation, each being capable of bringing a full train at a speed of about twenty miles per hour up the gradients and running at forty-five miles per hour on level track.

For comparison with these particulars it may be recalled that the South African locomotives, of which ninety-five have been supplied by the Metropolitan-Vickers Company, weigh 67 tons each, have motors of 1,200 h.p., and are arranged for operation in groups of three with multiple unit control.

The limiting feature here was the comparatively narrow gauge of 3 ft. 6 in. against 5 ft. 6 in. for the G.I.P. Railway.

The new G.I.P. locomotives will be of the double six-wheeled bogie articulated side rod type, a single body being carried on two trucks which are coupled together with an articulating joint. Each truck will have a twin motor equipment of 1,300 h.p. rigidly mounted upon it and driving a jack shaft through single reduction resilient gearing on each side. The jack shaft will transmit power to the inner axle of the truck through long connecting rods, and to the other two axles by means of coupling rods from the inner axle. The centre of gravity of the locomotive is comparatively high, and the main running axle boxes are inside the wheels.

The extension of electrification to the main lines of the G.I.P. Railway follows on the electrification of the Bombay Harbour branch on which service was inaugurated in February, 1925. Power is purchased from the Tata group of hydro-electric supply companies, whose power stations are situated on the Western Ghats about 50 miles inland from Bombay. Transmission is at 100,000 volts to receiving stations at Dharivi and Kalyan, and thence at 22,000 volts to the substations which supply direct current at 1,500 volts for railway operation. The substations for the Harbour branch are at Wadi Bander and Kurla, and are equipped with eight 2,500 kW. automatically operated rotary converter sets supplied by the Metropolitan-Vickers Electrical Company. Substations at Thana and Kalyan will supply current for the first 25 miles extension of the service to Kalyan, which is expected to be completed in July. The lines to Igatpuri and to Poona, for which electrification is proceeding, total about 150 miles.

Christmas at Sea

By F. W. Siddall

CHRISTMAS at sea! What memories the phrase evokes! Memories grave and gay: the depth of misery or the peak of happiness. But through the whole range there permeates the Christmas spirit; that peculiar softening of even the hardest nature, the feeling of friendliness that penetrates the most austere reserve, and that wonderful conviction that the season is different from all others which causes men to rise above their surroundings.

It was notably exemplified aboard a little barque many years ago. An old vessel, possessed of that sailor's horror, a windlass in the forecastle, she left the Mersey in late December, and the combination of circumstances will give an idea of the crew she carried. Not a man of us would have shipped had not sheer necessity driven; but times were bad, and even such a craft as she was represented something better than a precarious existence ashore.

Scarcely were we clear of the tug when regrets commenced. A head wind, amounting to gale force, met us in St. George's Channel. With cables still shackled on and hawse pipes open to the onslaught of the waves, our habitation was flooded at every plunge. Seas gushed through the openings like water from a fire hose, breaking over the windlass and splashing bunks until both blankets and bedding were sodden, each inflow threatening the stove which represented the only vestige of comfort that now remained to us.

A welcome sight to ships heading for Christmas on land—the famous Landing Stage at the Port of Liverpool. The clock shown, on the Royal Liver Building, is the largest electric clock in Europe and is one of the most notable landmarks of Mersey-side

With sailors' ingenuity we built a breakwater round it, subordinating all other convenience in a desire to maintain intact that one source of warmth and our only valuable possession. Carefully tended, its sides glowed red with the heat, hissing and spluttering as spray splashed over it, the hastily improvised funnel gushing smoke at every joint.

Of comfort there was none, but the bogey represented the fireside around which happy families were grouped, and as such was sacred.

Christmas Day dawned, not as one would have wished, in a steady flow of light from the horizon, but in a brilliant glow almost at the zenith, spreading downward until the east was flooded with light; a sure precurser of even worse weather.

Forecasts of the most pessimistic were fulfilled, for hardly was breakfast swallowed before the call of "all hands" brought out watch below and watch on deck alike, to clew up and stow sail before the ever-increasing squalls.

There was a limit even to sail stowing for, despite the urgent need of the ship for relief, there loomed an even greater danger—the threat of the land. Away to leeward, hard, black and uncompromising it shewed; a menace more deadly than any contained in the rising wind and sea. Sail must be carried if we were to weather it.

So, though every gust held possibility of loss of masts or yards, though every sea swept over her as it would a half-tide rock, flooding deck, leaping through the open hawse pipes and threatening to carry away the carefully-lashed chests, the barque held her course, canvas stretched to the utmost. Every man knew that reduced sail would ease her, but equally did he know it would be at the cost of added leeway, and every inch was precious.

Still it was Christmas and, stretched on chests, oilskin-clad, each looked for some ray of hope and happiness. Was it not *the* day, and was not the cook, good man, wrestling to provide a famous duff?

Occasionally one or another would make a dart for the galley to watch someone in worse case than himself. There the cook, endeavouring to maintain footing on the tiled floor, sought to control his pans as they slid to and fro on the range, watched his opportunity to lift the lid of a cauldron and stir its contents, what time he cursed a sea, which squirted through a crack of a closed door with a completeness which left nothing to the imagination.

Strange that the troubles of another can be so humorous; but everyone who paid a visit to the cook resumed his seat on a chest in high glee, content that someone else should be suffering even greater annoyance. At length vigorous banging of a tin announced that dinner was ready, and oilskin-clad figures clustered round the galley door eager to share in the cook's triumph.

Possibly the man at the wheel was more interested in their doings than in his immediate duty, perhaps the wind flawed, or a larger sea than usual took charge: which, if any of the circumstances was responsible none could say, but the barque swept up into the wind, a huge greybeard leapt aboard filling her fore and aft, the weather door of the galley gave before the impact and cook, utensils and gear swept in an avalanche over the waiting men.

In silence they returned—curses are reserved at sea for the minor troubles of life—and in silence were received by their waiting shipmates. Dinner, that long-hoped-for dinner, had gone, and attention was turned to the bread (biscuit) barge and water as the only relief

Without murmur or complaint we munched the hard biscuits, washed them down with draughts from the scuttle butt, and were settling down for a smoke to round off the feast when Jimmie, the boy, who had been busy in his bunk, appeared with a neatly apportioned orange. Poor little chap, he had kept it for Christmas, and in the hour of extremity divided it amongst the crowd.

At another time we might have laughed at the infinitesimal share available for each; but is not the orange a recognised article of Yuletide fare? Gladly each took his share, lingered over it, touched by the kindly thought behind the gift, and the Christmas spirit broke through regardless of the surrounding handicaps.

It seemed that the bogey ceased to smoke that the water swishing across the forecastle deck was not so cold, that with care a man *might* dodge those sudden gushes from the hawse pipes. Even the cook, from the most maligned man upon the seas, became somewhat of a martyr immolated at the shrine of duty, and old Green, the most confirmed of pessimists, was heard to express a hope that he had not been *badly* scalded.

Just one touch of the Christmas spirit had worked the change, and the report of the recently-relieved helmsman that "Ship's laying her course, boys," confirmed the feeling that matters were not so bad.

* * * *

But if the sea can provide a Yuletide which would fill the landsman with horror it can, and does, offer the joys of anticipation long drawn out, and in a measure the home dweller cannot equal. For him the festivities are assured, plans made far ahead, and pleasures taken as a matter of course. The sailorman has no such certainty, but a hope which can be canvassed for weeks; and, if there be a prospect of reaching a home port in time for the great day, that is joy indeed.

One such occasion springs to mind, when the good ship snorted homewards, her destination the inevitable "Queenstown for orders," a strong gale chasing her from the Western Islands right to the entrance to that famous harbour. A flutter of flags and she was away again, belying the pessimists who had foretold a long wait, swinging to an anchor, whilst the folks at home looked

for our coming. The orders were ready, and hardly had the answering pennant whipped to our peak than the main yard was swung and hands raced aloft to get sail on her again.

Now the home port was almost within hail, the girls of Liverpool had told of the tow rope, and the good sou'wester, that friend of the homeward bound, sent her along at a pace which made the heaving of the log a sheer delight. Watch vied with watch in brazen exaggeration of her speed and none contradicted, for the wish was father to the thought.

Occasionally an outward vessel would be seen, snugged down, punching into the seas which helped us on our way. Then we would leap into the rigging and give a cheer as we rushed by, happy in the knowledge that for us there was the pay table in prospect, with all the delights open to John just in from sea, even though Jack may be down channel.

Eagerly we noted and passed each well-remembered seamark until, with the Carnarvon Bay ship abeam, we felt actually in our own waters. The wind we knew would soon come out of the nor'west, the glass and the cloud indications proved it, and the only question was *how* soon? Would it hang in the south'ard until we were round the corner and sweeping across Liverpool Bay, or whip round at the wrong moment and perhaps demand a tack off-shore? It held, that good sou'wester, shifting in a squall which sent us flying among the branches, to wrestle with t'gallan-sls which had done their work right well.

With the northerly wind came clear, bright weather, and at daybreak the familiar funnel of a Liverpool tug shewed amongst the shipping to the eastward. Hurriedly, without waiting for any order, we snaked the towrope from the fore hatch, flaked it down clear for running, then crowded to the rail to listen to the bargaining. Under the main t'gallan's'l the good ship gave the tug all the exercise she needed, and our captain deigned only the most scanty notice of the steamboat; that, with such a breeze, her skipper should offer a tow he affected to regard as amazing. They played out their little comedy well, each fully conscious of the result, for the pilot boat lay off Point Lynas and, as we shortened sail and backed the yards for our pilot to board, the tug ranged alongside, whilst the two skippers discussed weather, prospects of getting the tide, anything and everything but the price of a tow. Each affected to believe his position was impregnable; we had a wind and could sail in; whilst the tugmaster regarded assistance as inevitable.

Just as we filled away again the tow boat captain named a figure which caused ours to take interest in the proceedings: possibly desire to spend Christmas at home himself may have had its effect; or the presence of that good sailing breeze might have done it. Sufficient for us that, after a few minutes' bargaining, the big steamboat moved forward, picked up our rope, and soon we were aloft making a "harbour stow" that no sailorman would be able to criticise.

A fine homecoming, the familiar sweep of Liverpool Bay, the sand-rimmed Cheshire shore gleaming in the early morning light which shewed the dark hills of Wales, their fields a wonderful mosaic of greens, in sharp contrast with snow-capped peaks. But ahead lay the lightship and lines of dipping channel buoys, best sight of all.

Her crew turned out to give us a cheer, one held aloft a bird all ready for the oven, whilst another threw aboard a small bunch of evergreen. Hardly had it touched the deck than one of the boys ran aloft and lashed it to the fore truck, that all might see we were a Christmas ship.

Swiftly the buoys slipped by, for ahead of us was Mersey's most powerful tug, with a tide to catch, and just as we passed the Rock light the bells of St. Nicholas' Church pealed out as if in welcome to the homeward bound.

* * *

For this account of Christmas at sea we are indebted to the Editor of "*Mersey*," by whose permission the article is printed here.

Preparing for a Christmas feast in Fiji

A Christmas Feast at Midsummer

My strangest Christmas, says an experienced traveller, was spent at a village in the Fiji Islands. The strangeness here lay not only in the surroundings and the fact that Christmas is at midsummer, but—more painfully!—in the diet.

The menu of the village Christmas feast in which it was my privilege to partake was, of course, worthy of the occasion, and far beyond the ordinary yam or taro, features of everyday breakfast, lunch, or supper in Fiji. Yam, and even taro, adequately cooked, are pleasing additions to the beef or mutton of the planter or Government Official; but the native notion of preparing anything is to serve it up half raw, whether flesh or vegetable, a rather drastic experience for any weak-framed Europeans who venture to stop with them and adopt their diet. Half-softened stone might be equally delightful and consumable.

As to solids, there was fish (obtained from a fairly distant inlet of the sea), pork, fowl, and banana. Green oranges and limes, unripe and acidly ungenial, needing sugar, completed the feast. It was entertaining to watch the great, fuzzy-haired, brown fellows, squatting in a circle, picking a big bone or knuckle, and rending the flesh, most audibly, with strong, firm teeth. Then, satisfied, they reclined and smoked hand-made cheroots of native-grown tobacco, solemnly in the intervals partaking of kava, the island wine.

Presentation of food in Fiji, a native custom observed every year

Results of
Meccano Model-Building Contests

By Frank Hornby

"Second Summer" Competition, "Home" Sections

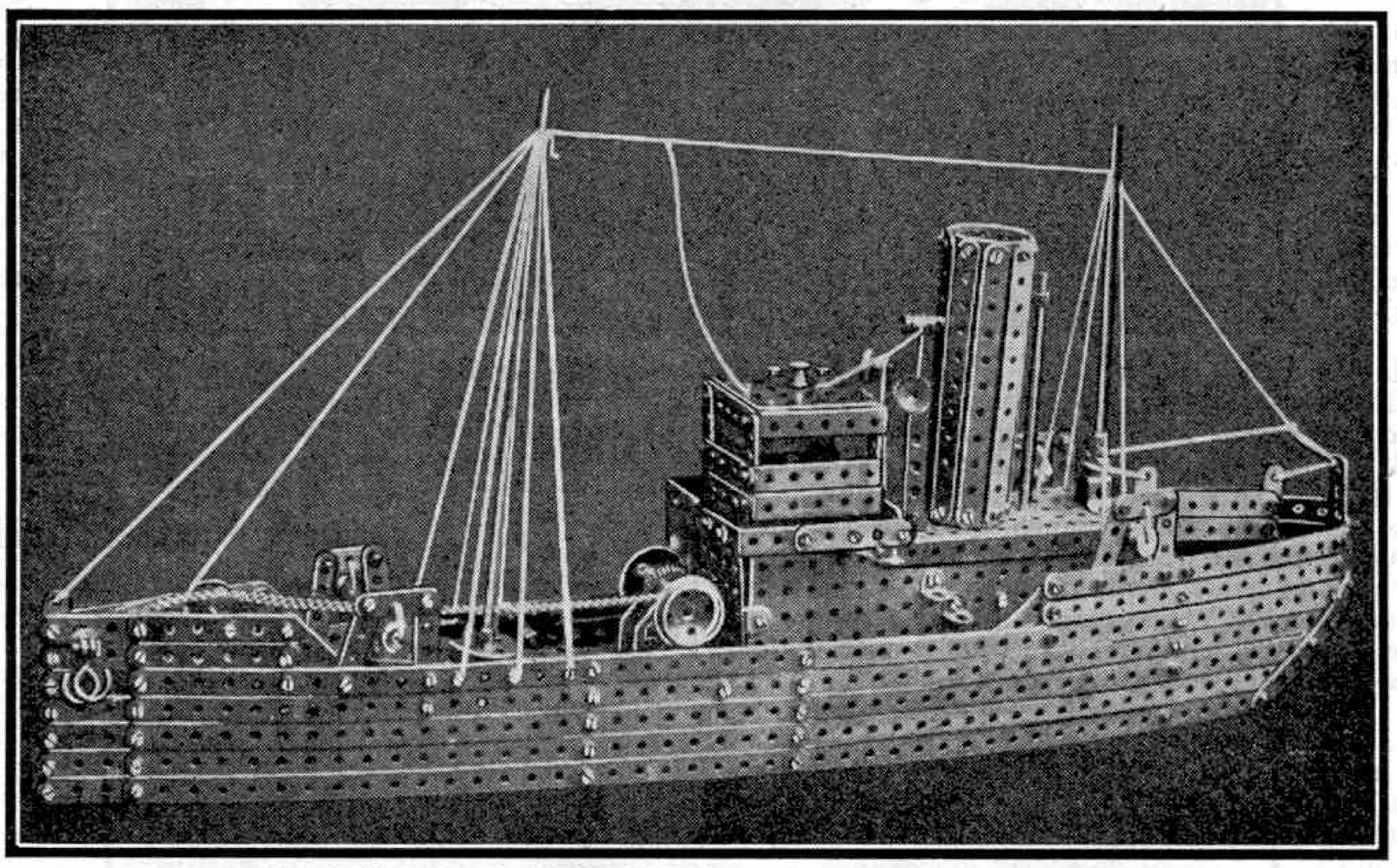
THIS competition was based on similar lines to the "First Summer" Contest, the results of which were published last month, and an equally large number of interesting entries were received. The names of the prize-winners in the three "Home" Sections are as follows :—

Section A (Competitors over 14 years of age).

FIRST PRIZE (Meccano products to value £2-2s.) : C. Cuckow, Lovett Street, Cleethorpes, Lincs. Second Prize (Meccano products to value £1-1s.) : John Redfern, Hough Lane, Lower Broughton, Salford, near Manchester. Third Prize (Meccano products to value 10/6) : Charles M. Sayer, 34, Hindes Road, Harrow, Middlesex.

SIX PRIZES, each of Meccano products to value 5/– : L. W. Grey, East Ham, E.6 ; James Wilson, Aberdeen ; Ralph Sewell, St. Ives, Hunts. ; Donald Martin, Shifnal, Salop ; Edgar Whatley, New Moston, Manchester ; Alfred Brunner, Upminster, Essex.

SPECIALLY COMMENDED (Certificates of Merit) : R. W. Rush, Accrington ; B. Adams, Westcliff-on-Sea ; C. Wilson, Southtown, Great Yarmouth ; R. S. Weaver, Prestwich, Manchester ; Eric Kennard, New Southgate, London, N.11 ; Edward Solly, Lenton, Nottingham ; J. Conroy, Papworth Everard, Cambs.



A model Steam Trawler, by Charles Cuckow. (Awarded First Prize in Section A)

Section B (Competitors over 12 and under 14).

FIRST PRIZE (Meccano products to value £2-2s.) : J. Prosser-French, Norbury Avenue, Thornton Heath. Second Prize (Meccano products to value £1-1s.) : Kenneth Garner, Ackworth School, near Pontefract. Third Prize (Meccano products to value 10/6) : F. A. Weemys, Belmont Road, Bushey, Herts.

SIX PRIZES, each consisting of Meccano products to value 5/– : F. N. Goodman, Brockley, London, S.E.4 ; Ronald Holloway, Southampton ; Robert Whittingham, Heckmondwike, Yorks. ; John C. Mears, Westcliff-on-Sea ; Peter M. Gough, Little Bromwich, Birmingham ; E. R. White, Wolverton, Bucks.

SPECIALLY COMMENDED (Certificates of Merit) : Gordon F. Clark, Great Missenden ; D. Nelson, Penarth ; D. Alan Wykes, Carshalton, Surrey ; J. Jacobs, Watford ; F. A. Dunkley, Earls Barton, Northampton ; T. R. Hughes, Birmingham ; B. Unné, Harrogate, Yorks. ; R. E. Owen, Birmingham ; R. G. Parker, Stokes Croft, Bristol.

Section C (Competitors under 12 years of age).

FIRST PRIZE (Meccano products to value £2-2s.) : Herbert Dean, Kingsway, Didsbury, Manchester. Second Prize (Meccano products to value £1-1s.) : James G. Yates, Sandiacre, Strand-town, Belfast. Third Prize (Meccano products to value 10/6) : John Warren Davis, Trewarren, St. Ishmael, Milford Haven, Pemb.

SIX PRIZES, each consisting of Meccano products to value 5/– : F. Hayes, Porthcawl, Glam. ; H. Douglas Hosegood, Selhurst, London, S.E.25 ; J. C. Waterlow, Marlborough, Wilts. ; Ian Bain, Worthing ; H. H. Lewis, Pontypool Road, Monmouthshire ; S. Hogg, Headingley, Leeds.

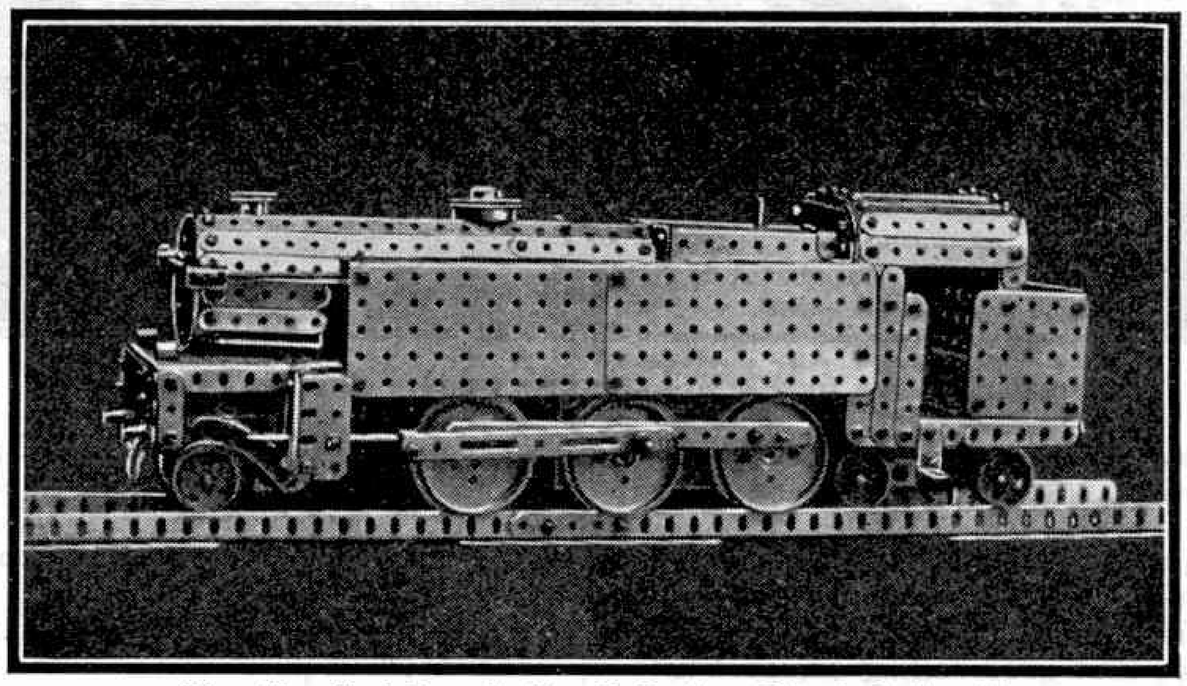
SPECIALLY COMMENDED (Certificates of Merit) : G. W. Cecil, London, E.2 ; B. Kimberley, Bristol ; George Scott, Little Lever, Bolton ; R. A. Hodgkin, Oxford ; W. Catten, Hove ; David Crowdy, Southwold, Suffolk ; George R. Watson, Cleethorpes ; Dennis Mason, Wolverhampton ; H. F. Bower, Brockley, London, S.E.4.

A Meccano Trawler

Charles Cuckow won First Prize in Section A with an extremely well-proportioned Meccano model of a steam trawler. We receive comparatively few realistic models of ships in connection with the Competitions, and as this is one of the best that has yet been submitted, I think the judges were justified in allotting the principal award to Cuckow. The lines of the hull are cleverly reproduced by means of a number of strips of different lengths, and the boat is equipped with such details as winches, port and starboard lights, ventilators (consisting of ¾" Contrate Wheels bolted to Strips), whistle, steam pipe, apparatus for handling the nets, and ship's boat, etc., etc. The use of two Hooks bolted together appealed to me as being a particularly ingenious method of reproducing an anchor. The model is of simple and straight-forward construction, and the building of a Meccano vessel of this type provides endless amusement and instruction.

An excellent model of an ash sorter and washer gained Second Prize for J. Redfern. Unfortunately, photographs of this interesting model are not available but perhaps the following short description will enable readers to obtain some idea of its construction.

The machine is of the type that is used in gas works to recover fuel from the clinkers delivered by the furnaces. The clinkers are first broken up by a hammer and conveyed in a crushed condition via a bucket elevator to the screen. The latter is carried on a trolley, which is given a rapid to and fro movement by means of a mechanism closely resembling that described under detail No. 261 in the Standard Mechanisms Manual. The carriage is provided with a series of trays (reproduced in the Model by Flanged Plates) that form the screen and the ashes are shaken through these and thereby sorted into three different



River Class Tank Loco, by Donald Martin. (Prize in Section A)

grades, according to their size. Two grades, comprising the finer ashes, are discharged from the machine via chutes into waiting railway wagons, while the remaining grade is taken from the machine by a bucket conveyor. A jet of water from a pump (also reproduced in the model) plays on the topmost screen and washes the contents thoroughly, at the same time helping in the grading process.

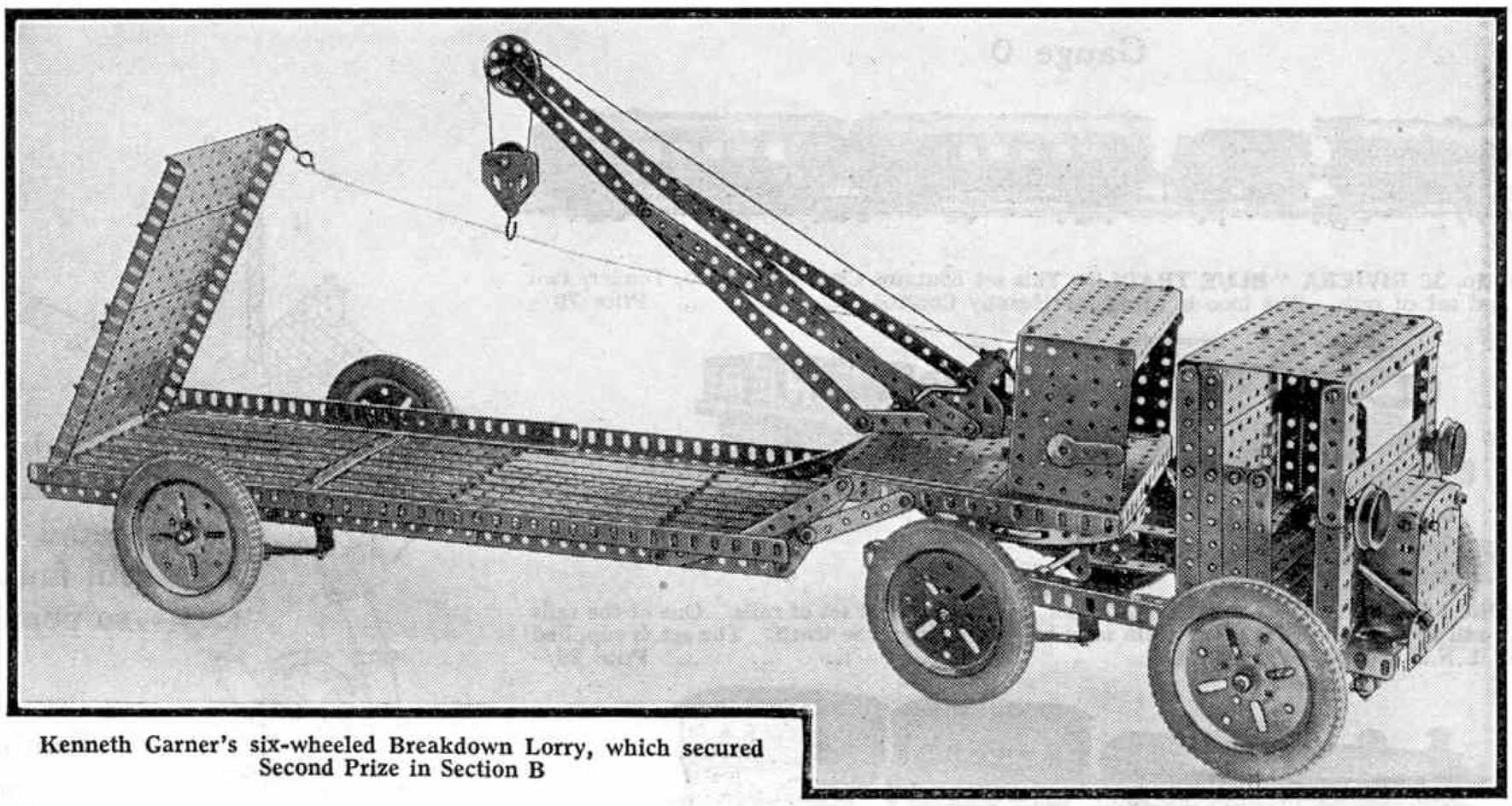
This is a fine model and I have put it aside along with many other prize-winning entries with a view to possible reconstruction by our model-building staff in the future.

Charles Sayer's Third Prize-winning model represents a radial travelling crane. One of the novel features of this crane, which influenced the judges considerably in awarding the prizes, was an adaptation of the Constantinesco Torque Converter incorporated in the primary drive. This is the first time that I have seen the Converter adapted to a crane, but it appears that some very interesting results can be obtained when it is used for this purpose. The various movements of the crane are operated from an Electric Motor mounted in the base of the model, where it acts as a counterpoise to the weight of the boom, and they are controlled from a gear box slung beneath the boom just in front of the main pivot.

Two other models that attracted my attention particularly in this Section were an electric express locomotive and a 2–6–4 "River" class Southern Railway tank engine. The latter model, by Donald Martin, is shown in an accompanying illustration. The engine is very well constructed and presents a most realistic appearance, but I should like to have seen the model fitted with Walschaerts' valve gear, as in the prototype. This would have enhanced the appearance of the model to a considerable extent.

Mr. L. W. Grey, the constructor of the electric locomotive, must already be well known to readers of the "*M.M.*," for we have previously illustrated two excellent models of his design. His latest model is fitted with eight driving wheels and a four-wheeled bogie at each end of the frame. The locomotive also carries two pantographs built up from a series of strips attached to the roof by Angle Brackets.

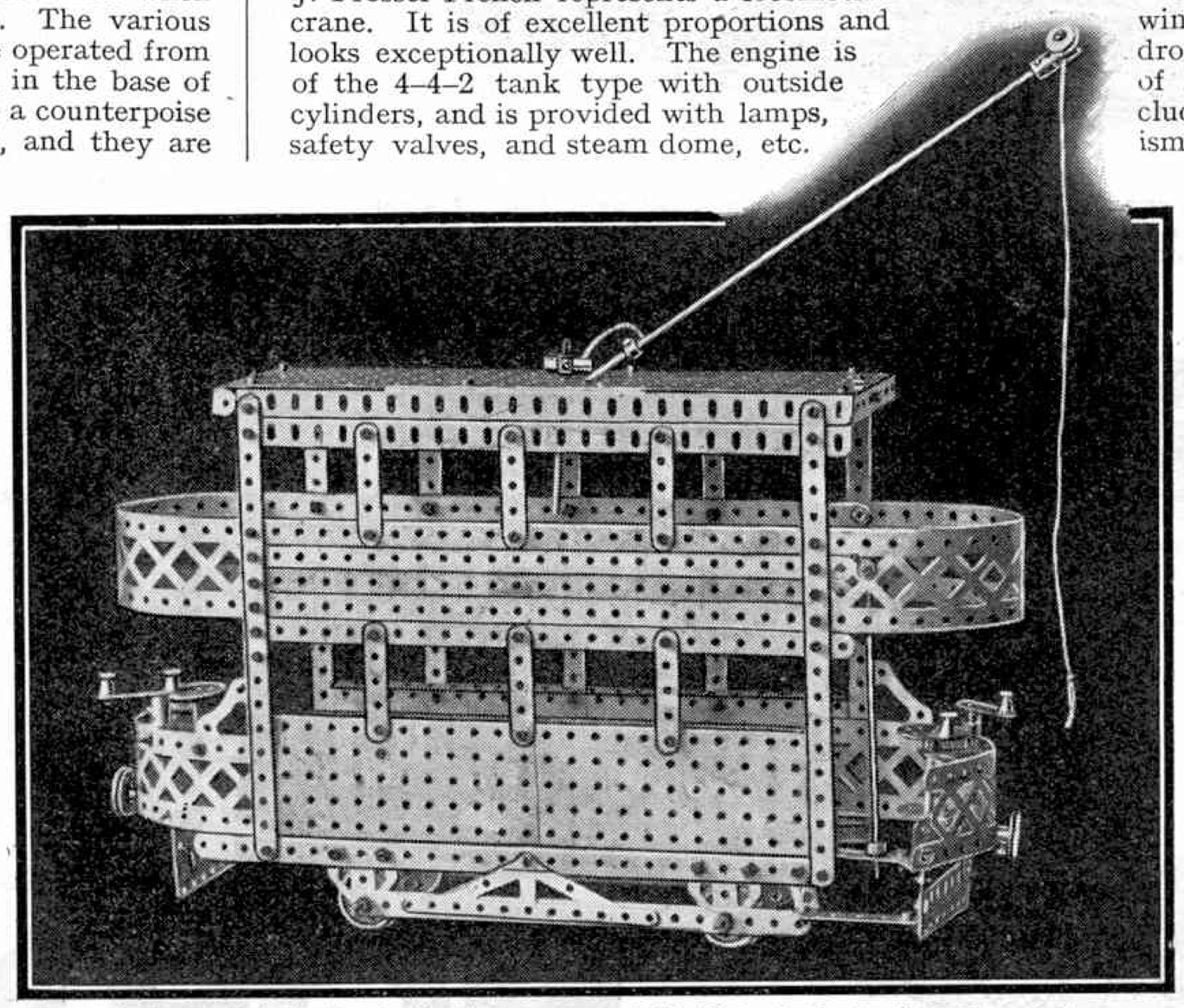
R. Sewell gained his award with a fine model of a motor cycle combination. A Meccano Clockwork Motor is mounted in the sidecar and the drive is led to the back wheel of the cycle via a two-speed gear box. The controls are so arranged that the Motor is started by first opening the throttle lever on the handle-bars and then depressing the kick-starter, thereby releasing the brake on the Motor.



Kenneth Garner's six-wheeled Breakdown Lorry, which secured Second Prize in Section B

Entries in Section B

The model submitted in this Section by J. Prosser-French represents a locomotive crane. It is of excellent proportions and looks exceptionally well. The engine is of the 4–4–2 tank type with outside cylinders, and is provided with lamps, safety valves, and steam dome, etc. The boiler is built up from a series of Strips bolted by Angle Brackets at either end to a pair of Face Plates. The crane is mounted on an extension of the coal bunker immediately behind the cab, the hoisting and slewing operations being carried out by hand. The jib is permanently fixed in a horizontal position, a common arrangement with this type of crane. I consider this is a fine effort for a boy only 12½ years of age, and I shall endeavour to illustrate the model in some future issue of the "*M.M.*"



This fine model of a Manchester Tramcar secured First Prize in Section C for Herbert Dean

The Second Prize was awarded to K. Garner for the interesting six-wheeled breakdown lorry illustrated herewith. We received a very large number of motor cars and lorries of all types in connection with the Competition, but readers will observe that a distinctly original note is struck by this entry. The model is well thought out and neatly constructed, but the steering gear does not appear to function. It should not be very difficult to rectify this, however, with the aid of a few extra parts. When the tail board is lowered a car may be hauled on to the trailer without difficulty, while the crane may be used for lifting heavy weights in the case of a severe accident.

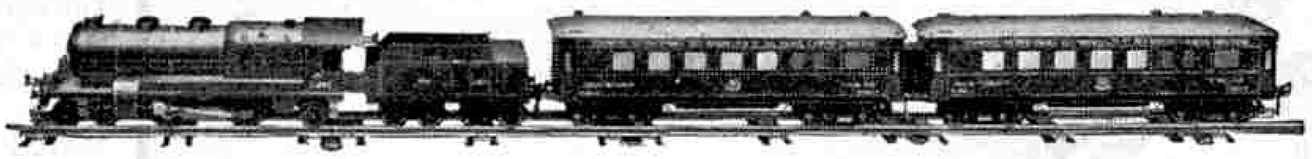
F. A. Weemys' Third Prize-winning model of an automatic drop hammer is a good example of Meccano engineering. Included in the operating mechanism is a 3" Pulley Wheel with a ¾" bolt secured in one of its holes. This slowly rotates, and as the hammer reaches the top of its stroke the ¾" bolt throws over a pivoted lever, which, in turn, slides the operating shaft and its Pinion out of engagement with a Gear Wheel on the main hoisting shaft, thereby permitting the hammer to fall. After a short interval the winding shaft is engaged again and the operation is repeated.

Some very fine entries are included amongst the other prize-winning models in this Section. I should like to mention specially the biplane submitted by Frank N. Goodman and a model fire escape by Ronald Holloway. The former model is fitted with three propellers operated from a 4-volt Electric Motor that is entirely concealed in the fuselage, and the movable rudder may be operated from a joy stick in the pilot's cockpit.

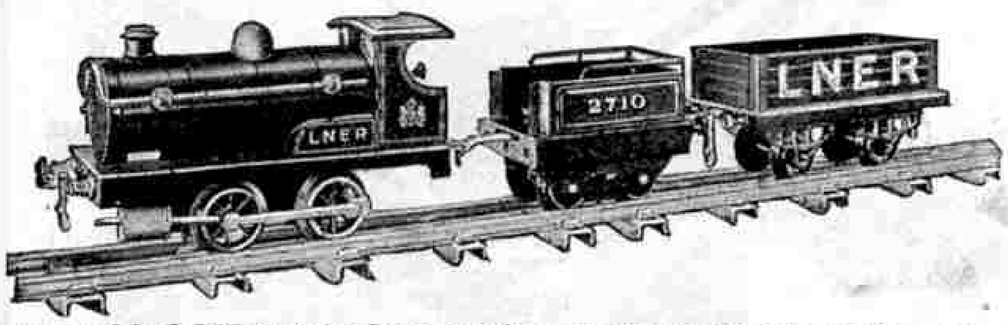
The Motor chassis in R. Holloway's fire escape is driven by a Clockwork Motor, and is provided with (*Continued on page* 1057)

THIS IS HORNBY

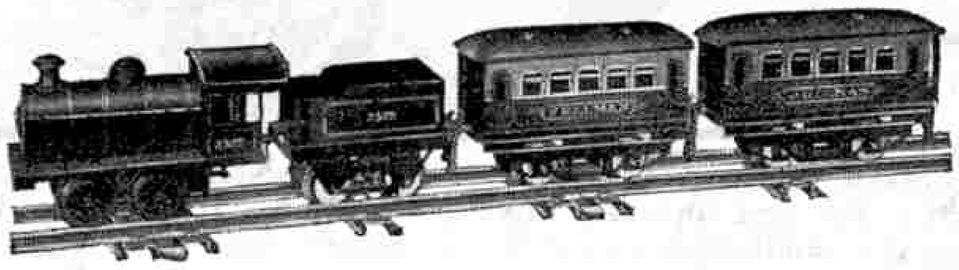
Gauge 0



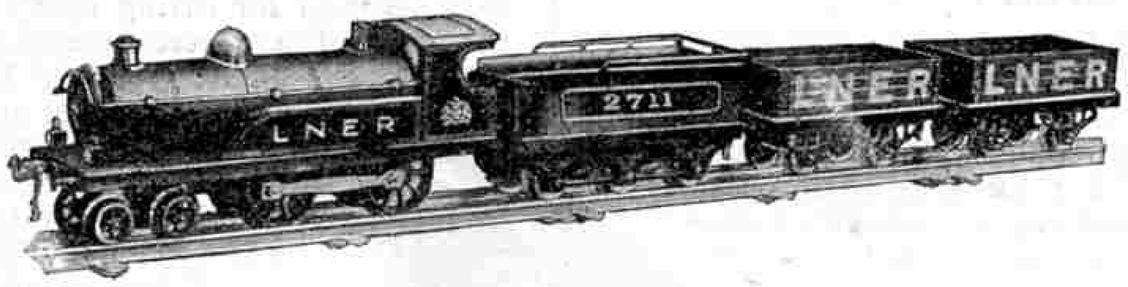
HORNBY No. 3C RIVIERA "BLUE TRAIN." This set contains Clockwork Loco, Tender, two Coaches and set of rails. The loco is fitted for Hornby Control ... ... Price **70/-**



HORNBY No. 1 GOODS SET contains Loco, Tender, one Wagon and set of rails. One of the rails is a Brake rail by means of which the train may be braked from the track. The set is supplied in L.M.S., L.N.E.R. or G.W. colours ... ... Price **20/-**

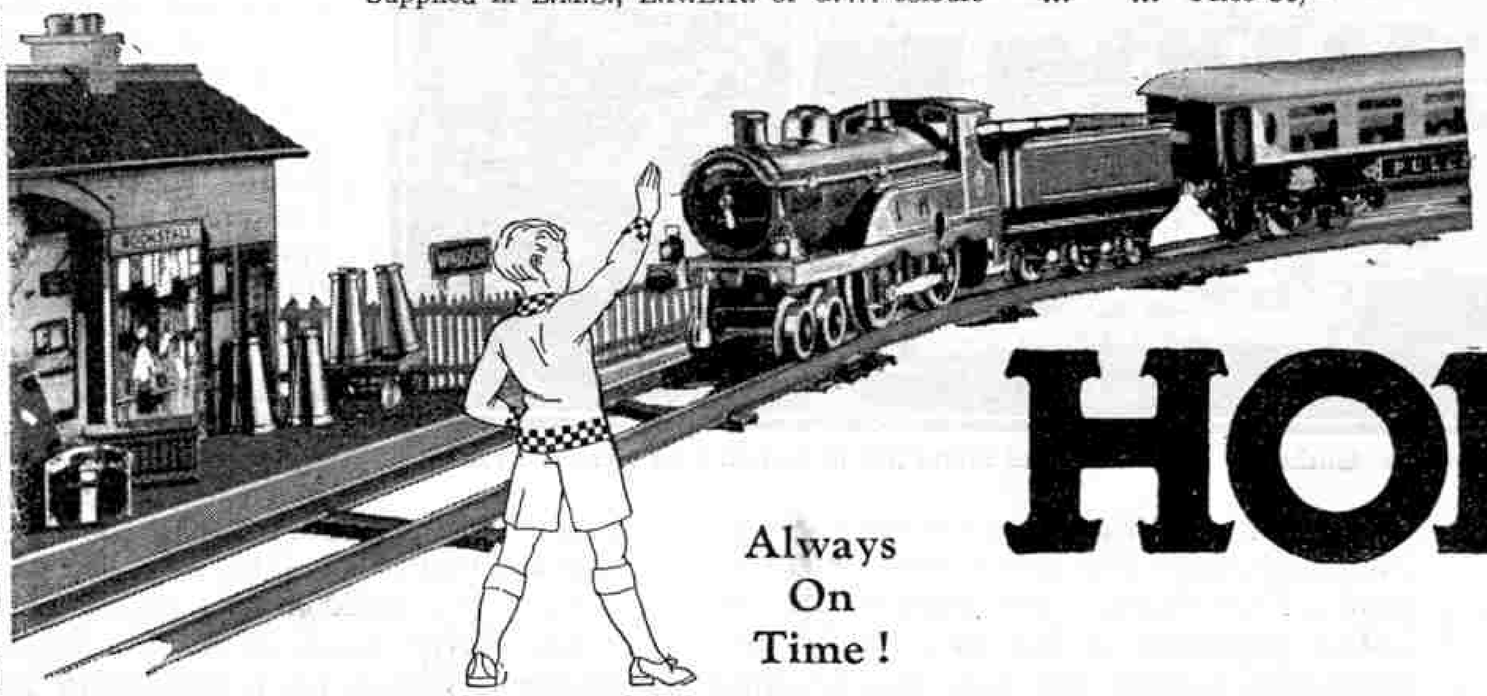


No. M1 PASSENGER SET. This set contains Loco, Tender, two Pullman Coaches and set of rails. It is richly coloured and well finished ... ... Price **7/6**



HORNBY No. 2 GOODS SET contains Loco, Tender, two Wagons and set of rails. The rails include one Brake rail by means of which the train may be both braked and reversed from the track. Supplied in L.M.S., L.N.E.R. or G.W. colours ... ... Price **32/6**

HORNBY No. 2 PULLMAN SET. This set includes Loco, Tender and two Pullman Coaches with set of rails. The rails include one Brake rail by means of which the train may be braked and reversed from the track. Supplied in L.M.S., L.N.E.R. or G.W. colours ... ... Price **50/-**



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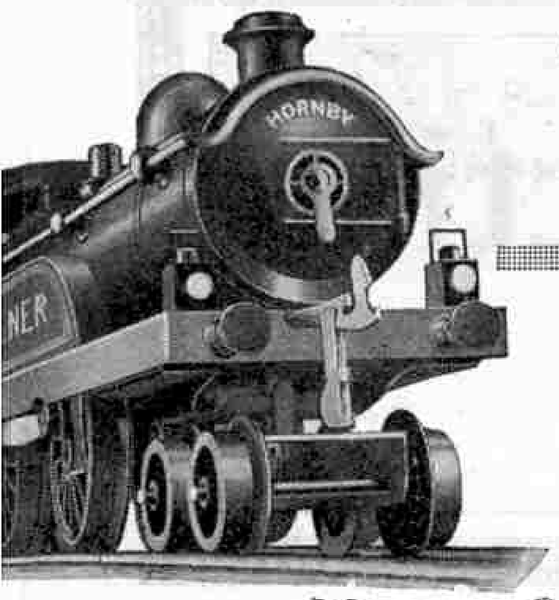
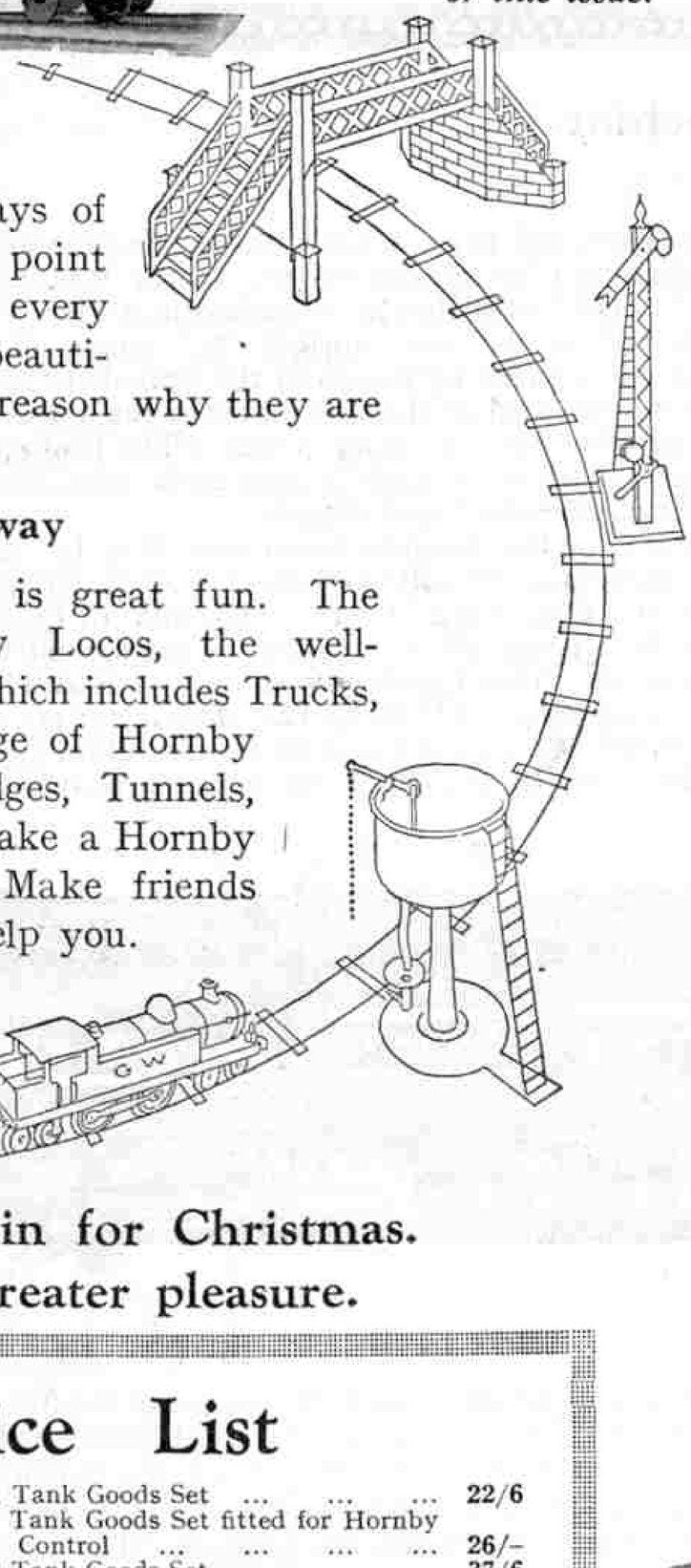


TRAIN WEEK

Send for the 1927-8 Hornby Book of Trains, price 3d.
See page 1068 of this issue.



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Hornby Train for Christmas.
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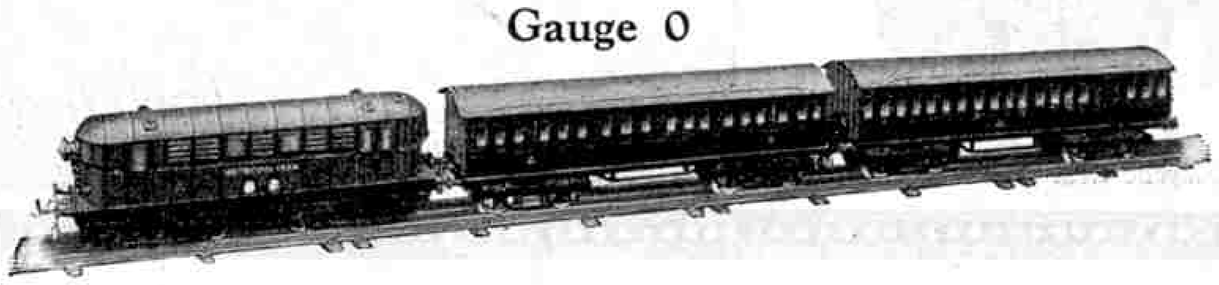
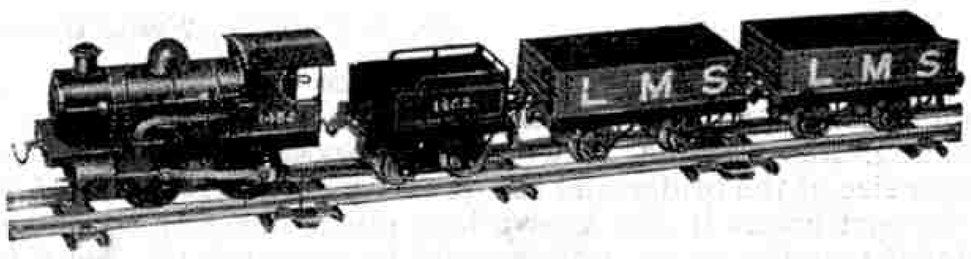
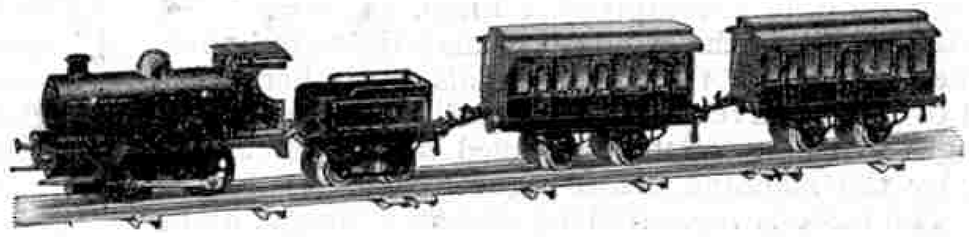
Gauge 0



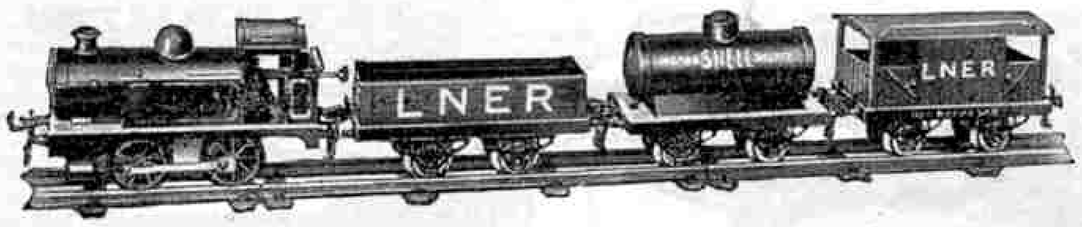
HORNBY METROPOLITAN TRAIN SET C contains a powerful Clockwork Loco, two Coaches and set of rails including a Control rail. The loco is fitted for Hornby Control ... Price **55/-**



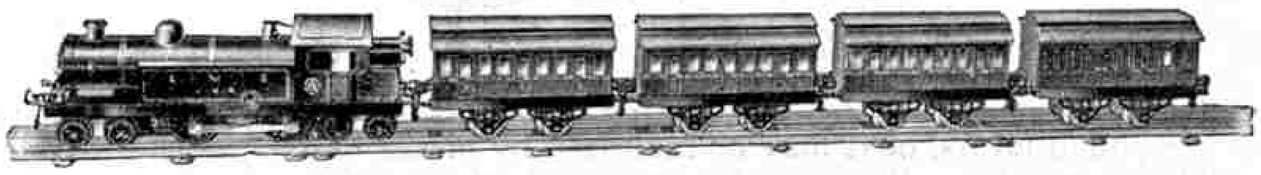
No. M3 GOODS SET. This set contains Loco, Tender, two Wagons and set of rails. It is printed in imitation of the colours of the principal British Railway Company's Rolling Stock ... ... Price **15/-**



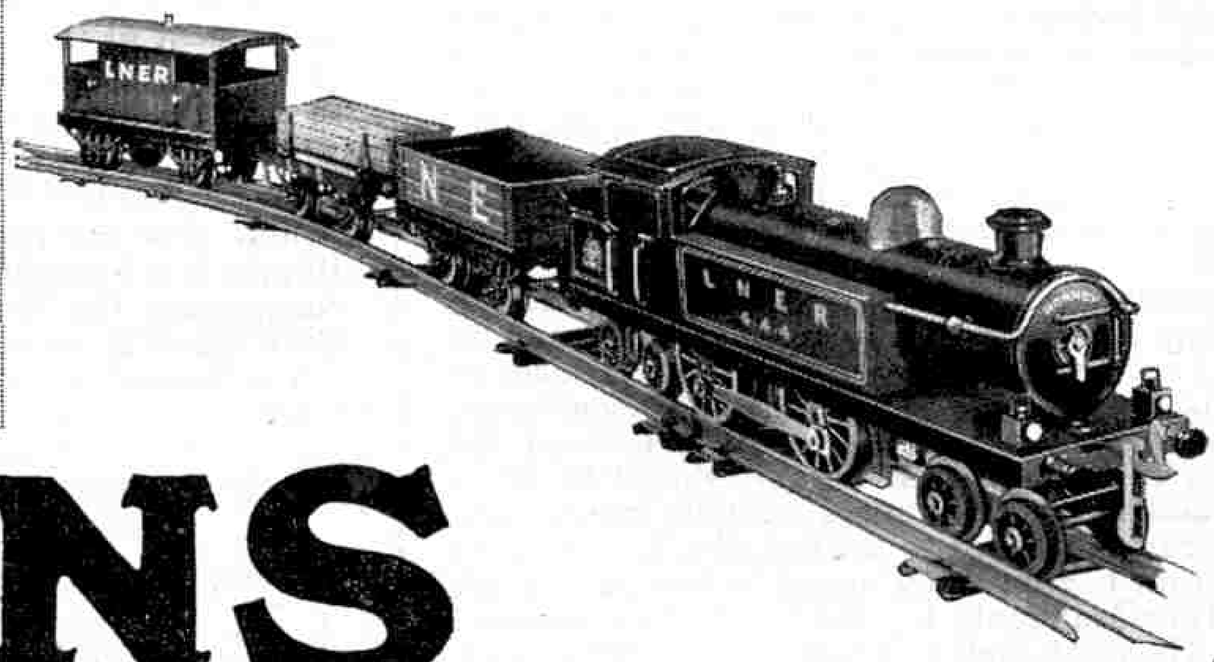
HORNBY No. 0 PASSENGER SET. This set contains Loco, Tender, two Passenger Coaches and set of rails. One of the rails is a Brake rail by means of which the train may be braked from the track. Supplied in L.M.S., L.N.E.R. or G.W. colours. Price **22/6**



HORNBY No. 1 TANK GOODS SET. This set contains a Hornby No. 1 Tank Loco, Hornby Wagon, Petrol Tank Wagon, Brake Van and set of rails, including a Brake rail. Supplied in L.M.S., L.N.E.R. or G.W. colours ... ... Price **22/6**



HORNBY No. 2 TANK PASSENGER SET. This set contains a Hornby No. 2 Tank Loco, three Passenger Coaches, one Guard's Van and set of rails including a Brake rail. Supplied in L.M.S., L.N.E.R. or G.W. colours ... ... Price **40/-**



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„	Metropolitan Train Set L.V. (4 Volt) ...	95/-
„	Metropolitan Train Set C (Clockwork) ...	55/-
Riviera "	Blue Train " Set No. 3E (4 Volt) ...	85/-
„ „	„ „ 3C (Clockwork) ...	70/-

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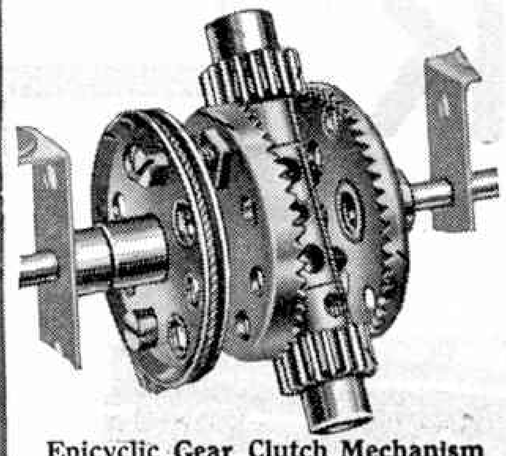


Epicyclic Gear Clutch Mechanism

Suggestions Section

Edited by "Spanner"

(105)—Meccano Testing Machine

(G. S. Cunliffe, Fortis Green, London, N.2)

IN all engineering work it is of the utmost importance that the strength or durability of various materials should be known. In bridge-building, for example, it would be impossible to determine the proper size of the bridge and the quantity of material necessary for its support unless it was known how much stress or strain each individual member of the bridge could be expected to withstand with safety. A tie or strut used in any engineering structure must be of a certain shape in order to best resist the stresses to which it is subjected. Thus a girder designed to withstand a tensile stress may be of an entirely different shape to one intended to oppose only a compressive force.

Machines used to determine the strength of materials are known as testing machines, and with their aid metals or timbers, etc., may be subjected to compressive, tensile, or bending stresses. The hardness or strength of the specimen is gauged by the force that must be exerted by the machine before signs of compression or rupture appear. The force is measured by sliding a weight along a steelyard that is connected to the testing mechanism by a system of compound levers, or it may be indicated by means of a suitable dial and pointer. It is usually expressed of course in pounds or tons per square inch. The enormous power required in large testing machines is obtained by a hydraulic ram.

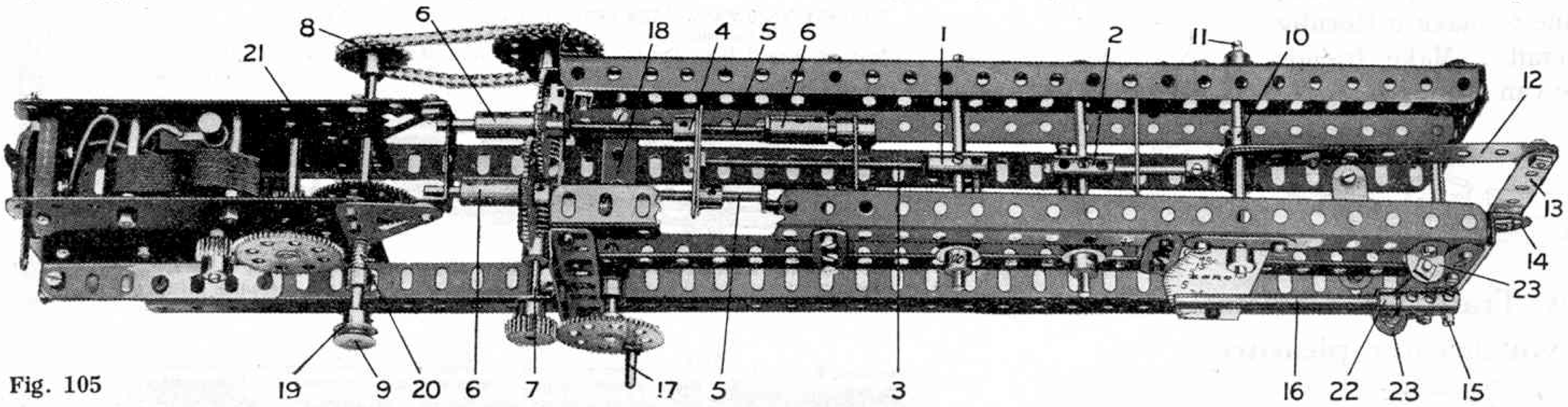


Fig. 105

The Meccano model testing machine shown in Fig. 105 should prove particularly interesting to Meccano boys in view of the fact that actual tests may be made with its aid. It is sufficiently powerful to crush matches or to break threads and thin wires, and some interesting experiments can be carried out by noting in each case the readings on the indicating dial. In addition, the model forms a very interesting demonstration of the power of a Meccano 4-volt Electric Motor.

The jaws of the machine, which grip the specimen to be tested, are represented in the model by a Threaded Coupling 1 and an ordinary Coupling 2 secured at their centre transverse holes to $3\frac{1}{2}''$ Rods. These Rods carry at each end a $\frac{1}{2}''$ loose Pulley mounted between two Collars, and the Pulleys are guided between the edges of two parallel $12\frac{1}{2}''$ Angle Girders. Care should be taken in adjusting the Girders so that the Pulleys are quite free to turn. The Coupling 1 is securely fastened to the end of a $3\frac{1}{2}''$ Threaded Rod 3, and this in turn is gripped by means of two nuts in the centre holes of two Threaded Cranks 4. The Cranks 4 are mounted on two parallel $3\frac{1}{2}''$ Threaded Rods 5, which are inserted at each end in Threaded Couplings 6 and rigidly secured by means of nuts screwed tight against the Couplings. Two pairs of 1" Rods inserted in the other ends of the Couplings 6 form the journals on which the Threaded Rods 5 turn; they are mounted in suitable bearings formed from Double Angle Strips.

The parallel Threaded Rods 5 are rotated simultaneously and in the same direction by means of two Worm Wheels secured to a $3\frac{1}{2}''$ Rod 7. The latter Rod is journalled in a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted to the rear upright $3\frac{1}{2}''$ Angle Girders of the frame, and it is rotated by means of the Sprocket Chain drive 8 from a shaft 9 journalled in the side plates of the 4-volt Electric Motor, which supplies the necessary power. The Rod 9 is driven from the Motor armature through a gear train consisting of two $\frac{1}{2}''$ Pinions and two 57-teeth Gear Wheels.

The other jaw 2 of the machine is secured to a $1\frac{1}{2}''$ Axle Rod sliding in the centre hole of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip secured transversely in the framework of the model, and an End Bearing secured to this Rod is attached pivotally to the second hole of a Boss Bell Crank 10. This Crank pivots on the Rod 11 and its other arm is extended by a $4\frac{1}{2}''$ Strip 12. The latter is connected pivotally by means of a bolt and two nuts (see Standard Mechanism No. 262) to a $2\frac{1}{2}''$ Strip 13, the other end of which is attached by a similar method to the end of a Crank 14 secured to the $3\frac{1}{2}''$ Rod 15. The Rod 15 carries a Coupling, and a $3\frac{1}{2}''$ Rod 16 secured in this forms a pointer to record the force exerted by the machine.

The jaws 1 and 2 are provided with ordinary bolts by means of which the specimens to be tested are gripped. The preliminary adjustment of the jaws is effected by a hand wheel 17, consisting of a 57-teeth Gear Wheel secured to a $3\frac{1}{2}''$ Axle Rod journalled in the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 18. This Gear Wheel engages with a $\frac{3}{4}''$ Pinion on the Rod 7. Before the hand wheel can be operated, the Rod 9 must be thrown out of engagement with the Motor. For this purpose a knob 19 is provided, and on pressing this the Rod 9 may be moved longitudinally in its bearings, thereby compressing the Spring 20 (part No. 120b) and throwing the Gear Wheel 21 out of engagement with its Pinion.

The movement of the pointer 16 is controlled by two short lengths of Spring Cord, each secured at one end to the pointer between the Coupling and the Collar 22 and at the other end to a $\frac{1}{2}''$ Bolt inserted in Angle Brackets 23.

Parts Required :—

1 of No. 2A	6 of No. 16	8 of No. 38	9" of No. 94
2 " " 3	1 " " 17	1 " " 48	1 " " 95A
1 " " 5	1 " " 18A	3 " " 48A	1 " " 96
1 " " 6	4 " " 18B	1 " " 48B	2 " " 111A
6 " " 6A	5 " " 23A	2 " " 58	1 " " 115
2 " " 7A	1 " " 25	19 " " 59	1 " " 120B
4 " " 8	2 " " 26	1 " " 62	1 " " 128
4 " " 9B	5 " " 27A	2 " " 62A	2 " " 133
1 " " 9D	2 " " 32	2 " " 63	1 " " 166
2 " " 12	71 " " 37A	5 " " 63C	1 4-Volt
2 " " 15A	60 " " 37B	3 " " 80A	Electric Motor

(106)—A Curious Right-Angle Drive

(J. Sant Manduca, Notabile, Malta)

The curious Meccano model shown in Fig. 106 is inserted in view of its general interest rather than its practicability as far as Meccano model-building is concerned. It is a model of a device designed to provide a method of transmitting motion from one shaft to another without the use of bevels or other toothed gearing. We are unable to call to mind any instance in actual practice where this mechanism is employed, but we believe that Meccano boys will be able to make some use of it in connection with their models. In any case the novelty and ingenuity of the device make its construction well worth while.

A drawing of the actual mechanism is shown in Fig. 106a. From this it will be seen that each of the rotating shafts A and B has four equally spaced holes drilled longitudinally in its end, and into these holes are inserted four rods C, each of which is bent at right angles. When one of the shafts is rotated, its movement is transmitted to the other by means of the transverse pull that it exerts on the connecting rods. While the shafts rotate the rods C slide in and out of the holes, and as the outer rod is always thrust farthest from the ends of the shafts, they continue so to move without any possibility of fouling.

Explanation of the Model

The operation of the device is made quite clear in the Meccano model. The main shafts (A and B in Fig. 106a) are represented in the model by means of two pairs of $1\frac{1}{2}''$ Pulley Wheels 1 and 2, and the four connecting rods C by four pairs of 5" Rods 3, each pair being connected at right-angles by a Coupling.

The two $1\frac{1}{2}''$ Pulleys 1 are secured 2 in. apart on the 8" Rod 4 which, for the sake of convenience, is journalled in a framework consisting of four $9\frac{1}{2}''$ Angle Girders bolted to the base and connected at the top by two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and two $4\frac{1}{2}''$ Strips. The wheels 2 are secured $2\frac{1}{2}$ in. apart on the vertical rod 5, which is journalled in a foot-step bearing consisting of a $1\frac{1}{2}''$ Strip supported by two $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to the base. The Rods 3 are allowed to slide freely in suitable holes in the $1\frac{1}{2}''$ Pulleys.

One's first impression on seeing the model is that the shafts could rotate only with great difficulty, if at all, but this impression is quickly dispelled when one of the rods is turned, for the whole apparatus moves with a surprisingly smooth and easy action. Its operation will be improved, of course, if the Rods 3 are oiled at the points where they slide in the $1\frac{1}{2}''$ Pulleys 1 and 2. Care must be taken to see that the four pairs of Rods meet exactly at right-angles.

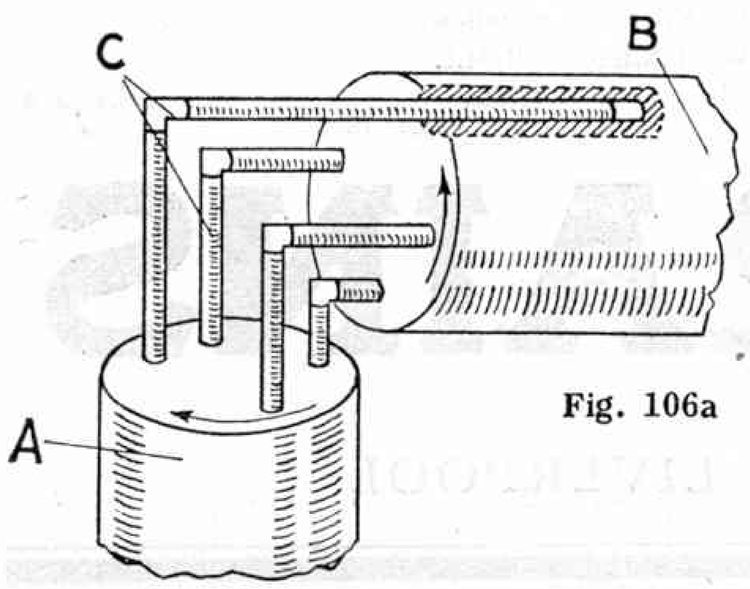


Fig. 106a

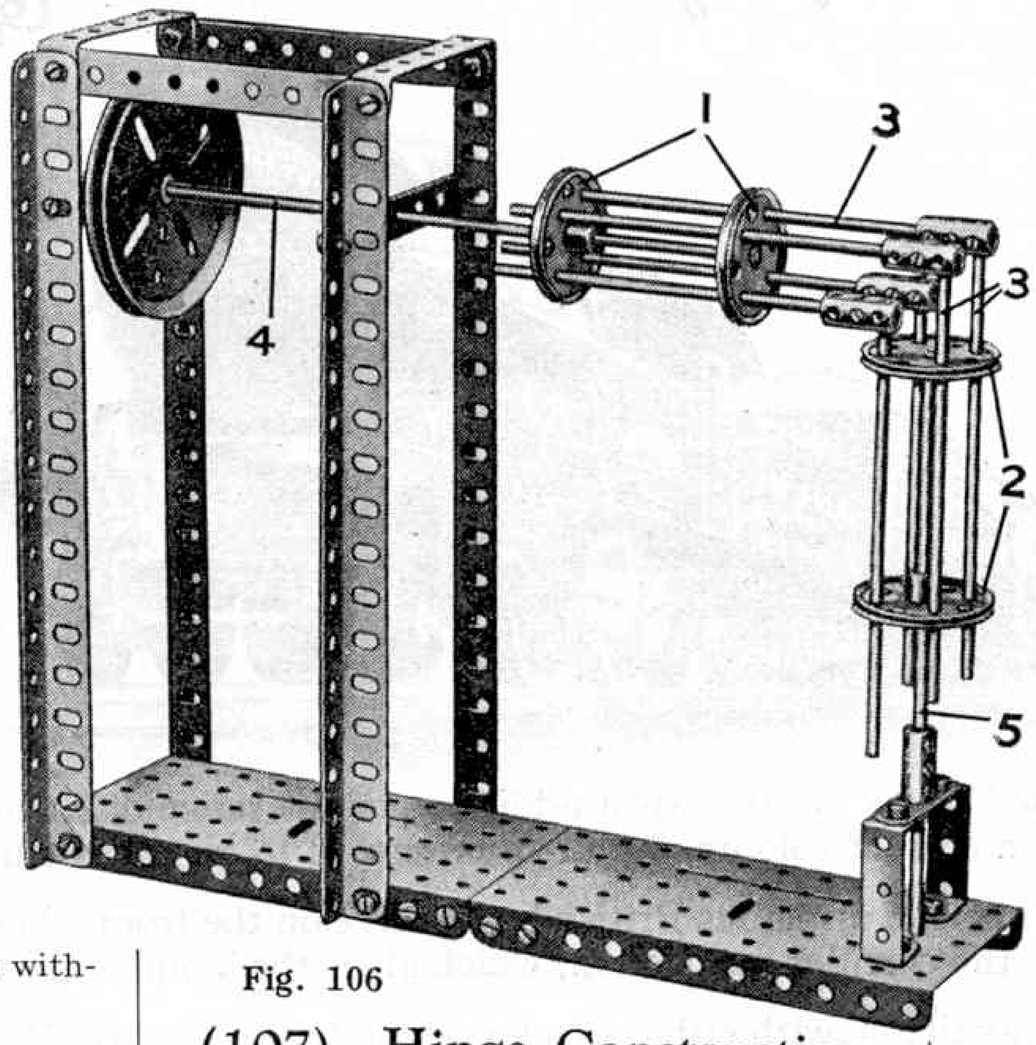


Fig. 106

(107)—Hinge Construction

(R. Fieldhouse, Weston-super-Mare)

Meccano model-builders sometimes find that the ordinary Meccano Hinge (part No. 114) is scarcely suitable when it is required to mount a heavy door in a model safe, etc., for the heads of the bolts used to secure the Hinge get in the way and prevent the door from lying flat against its frame. In order to overcome this difficulty R. Fieldhouse set to work and devised a pair of hinges from a number of Collars, with excellent results. His idea is illustrated in Fig. 107.

It will be seen that each hinge consists of seven Collars mounted on a $2\frac{1}{2}''$ Axle Rod 4. In each hinge Collars 1 and 2 are secured to the door by means of an ordinary bolt passed through the $5\frac{1}{2}''$ Angle Girder 3, which forms part of the door. It will be noted that nuts are placed on the bolts between the Collars and the Girder; the object of these is to ensure that the shanks of the bolts do not grip the $2\frac{1}{2}''$ Axle Rods 4. Two other Collars in each hinge are secured to the jamb of the door by means of ordinary bolts suitably spaced by a pair of Washers. These bolts also serve to grip the Rods 4 in position. The remaining three Collars in each hinge are inserted for spacing purposes, and should be free on the Rods.

Hinges of this description will prove very useful for purposes other than the construction of doors. For example they will serve admirably as a means of attaching a lift-bridge to its anchorage, and they should prove invaluable when constructing tipping wagons or railway trucks with hinged sides.

Miscellaneous Suggestions

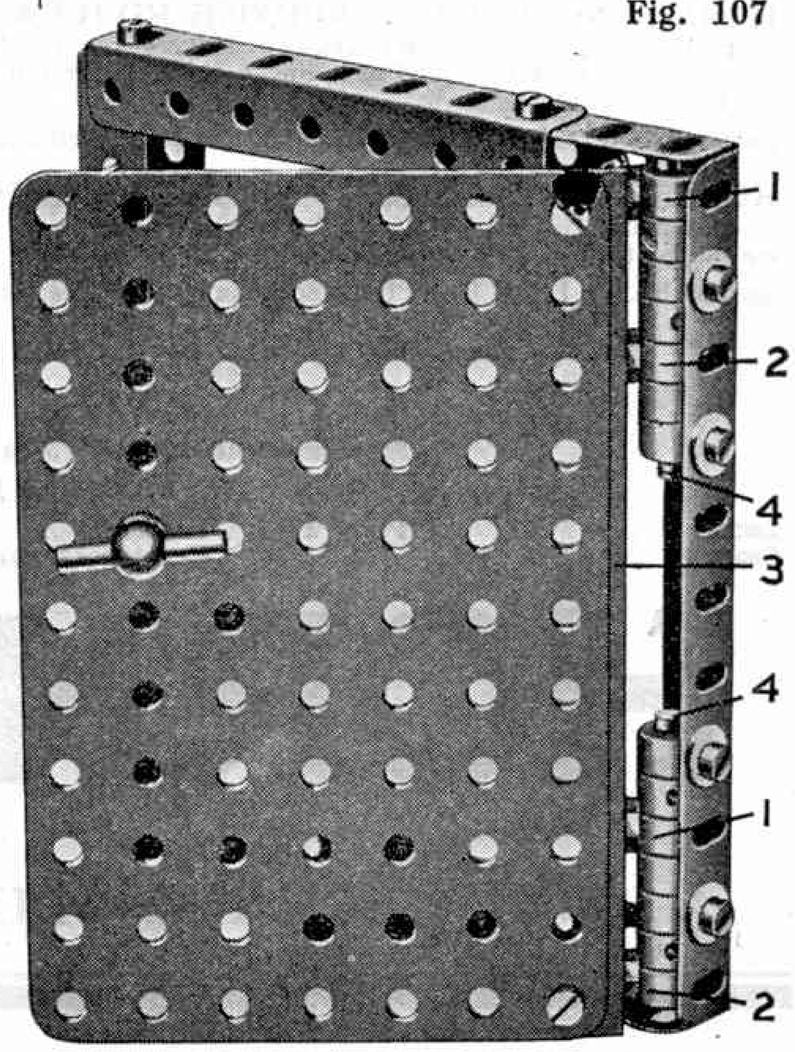
Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.9). Fuse for 4-volt Accumulator.—C. T. Parry, of Waimate, New Zealand, has submitted an interesting suggestion concerning the construction of a fuse for use in connection with the Meccano 4-volt Accumulators. The fuse consists essentially of a $2\frac{1}{2}''$ Strip on which is mounted two insulated terminals, one at each end. A strip of tin foil, of the kind that is found in cigarette boxes, etc., forms the fuse proper, and is clamped between two Flat Brackets attached to each terminal. Provided that it is not too wide, the strip of tinfoil will fuse at a low temperature and will thus effectually protect the accumulator from an excess of current.

(M.10). New Meccano Radiators.—A. E. Wood, of Rotherham, suggests that the Meccano Springs (part No. 43) may be used to advantage in the construction of model motor car radiators. Arranged vertically in a suitable framework, they represent the tubes through which the water is pumped. We have put this idea to the test and can recommend it to all "*M.M.*" readers.

(M.11). Razor-Sharpening Machine.—"A Meccano Wood Roller covered with leather forms an efficient sharpening device for safety-razor blades," writes K. C. Howick (South Nutfield). "It should be mounted in a suitable framework and driven by hand or motor. The razor blade to be sharpened is bolted to a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, and the latter is mounted in the framework in such a manner as to permit the razor blade being pressed on to the revolving roller." This is quite a practicable idea, although it should be pointed out that it is not advisable, even if it is possible, to re-sharpen certain types of safety-razor blades after use.

Fig. 107



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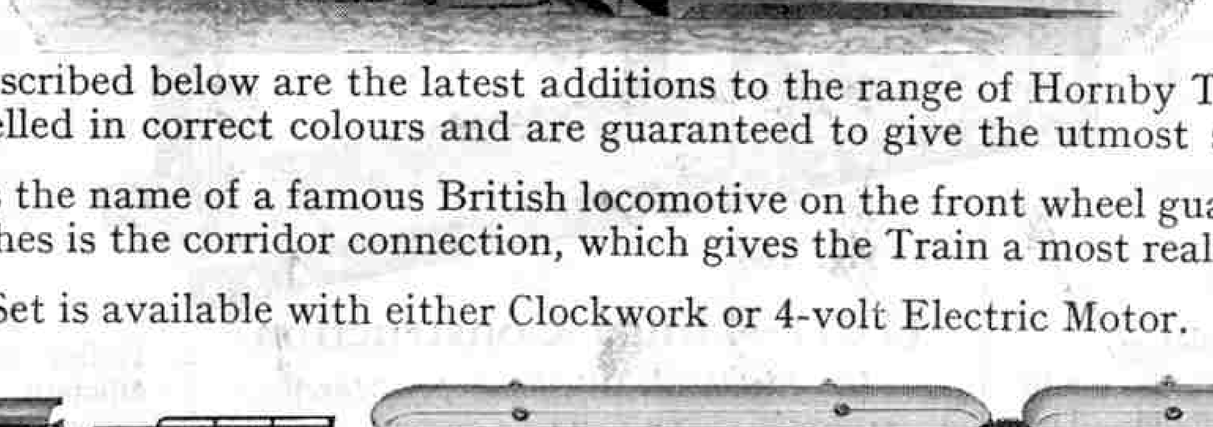

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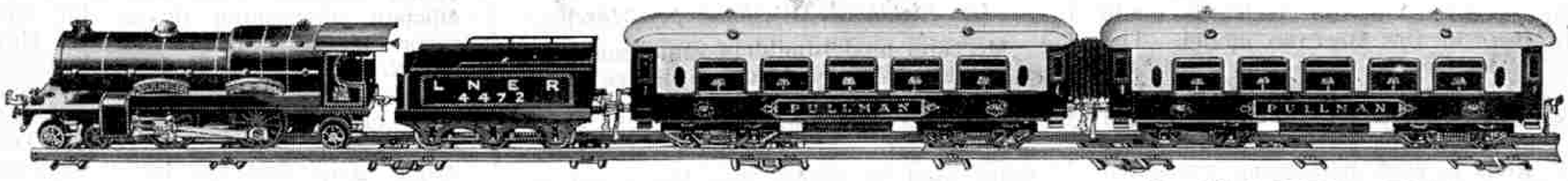

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Electricity Applied to Meccano

II.—The Dynamo and the Electric Motor

IN last month's article of this series we dealt with the production of electricity by means of primary cells and the storage of energy in accumulators. We must now pass on to the principles that underlie the production of electric current on the large scale required in everyday life.

In order to understand the generating of electric current by dynamos and the utilisation of the current in electric motors and other apparatus, it is necessary to have some knowledge of magnetism. Magnetism probably was known and studied before electricity, as the result of the common occurrence in certain parts of the world of a stone that has the peculiar power of attracting iron. This lodestone, as it is called, is a mineral containing iron, and the name magnet probably was derived from Magnesia in Asia Minor, where the mineral was found in large quantities.

If a piece of lodestone is hung up by a thread it always comes to rest pointing almost due north and south. This fact was known to the Chinese at a very early period and is mentioned by a Norwegian writer who lived a thousand years ago. The end of the stone that points approximately in the direction of the earth's north pole is known as the "north-seeking" pole, or more commonly the "north" pole of the lodestone, while the opposite end is the "south-seeking" or "south" pole. It was from this power of pointing to the north that the lodestone acquired its name, which is derived from the Anglo-Saxon word "laeden," meaning to lead.

At a later period it was found that pieces of steel could be made into artificial magnets that were better in many respects than the natural ones. The simplest method of making a piece of steel into an artificial magnet consists in stroking it repeatedly in one direction from end to end with one pole of a piece of lodestone. If the north pole of the lodestone is used for this purpose then the end of the piece of steel last touched by the lodestone will be the south pole of the new magnet. Soft iron also may be magnetised in this manner and, indeed, much more easily than steel but on the other hand it soon loses its magnetism whereas the hard steel retains it.

Pieces of iron may be magnetised temporarily without actually touching them with a magnet. If, for instance, one end of a bar magnet is brought close to but not touching the end of a piece of soft iron, the latter becomes magnetised and acquires the power of attracting iron filings or another piece of iron. As soon as the magnet is taken away, however, the magnetism of the soft iron disappears. This process is known as magnetisation by induction. It is interesting to repeat this experiment with a piece of glass, paper or wood between the magnet and the piece of iron and it will be found that these substances do not interfere with the action of the magnet. On the other hand if a sheet of iron were interposed the piece of soft iron would remain unmagnetised.

If a small magnet is suspended by a thread we shall find that like the lodestone it takes up a north-and-south position. We shall also find that if we bring near each end of it in turn the ends of another similar magnet the two north poles and the two south poles will repel one another but the north pole will attract the south pole and vice versa. Thus it is evident that whereas both poles of a magnet attract unmagnetised iron or steel the similar poles of two magnets repel one another while the opposite poles attract each other.

If a thin layer of iron filings is spread over a sheet of cardboard and a magnet is moved to and fro beneath the sheet, the filings stand up on their hind legs, as it were, as the magnet approaches them and follow it about as if pulled by invisible strings. Actually the magnet does act by means of invisible strings that are known as lines of magnetic force. These lines proceed from the poles of a magnet in certain definite directions and although we cannot actually see them it is quite easy to show how they work. In order to do this a magnet is placed beneath a sheet of cardboard or glass upon which iron filings are sprinkled thinly and evenly. The sheet is then tapped gently with a pencil. This tapping causes the filings to jump up from the surface of the glass so that they are momentarily freed from friction with it. During that momentary freedom the influence of the magnet is able to re-arrange the filings according to the direction of the lines of the magnetic force that issue from it. The filings thus provide us with a map showing the general direction of the lines of force.

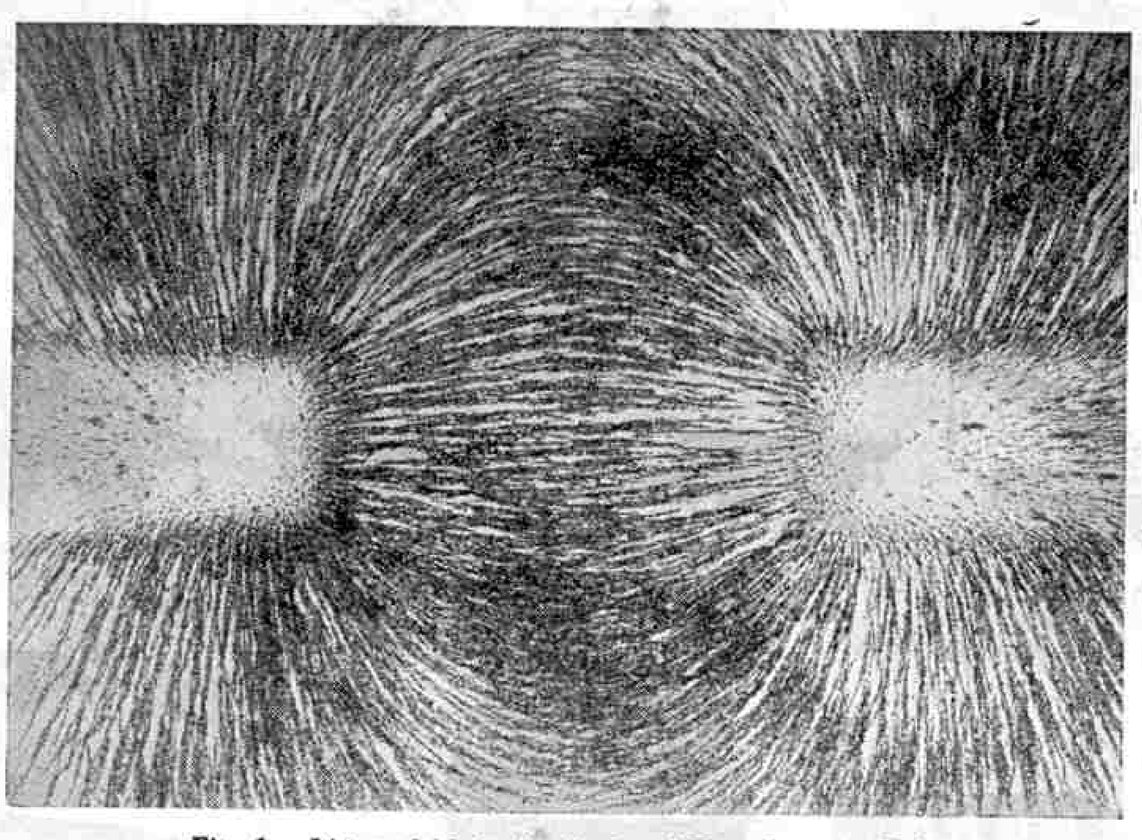

Fig. 1. Lines of Magnetic Force of Two Opposite Poles

By using different combinations of two or more magnets a great many very interesting maps may be made in this manner. Fig. 1, for instance, shows the lines of force between two opposite and mutually attractive poles of two bar magnets. It will be seen that the lines appear to stream across from one pole to the other. If the experiment is repeated with two similar poles the lines of force do not stream across but after proceeding a certain distance turn aside as if pushing one another away.

Any space containing lines of magnetic force is usually described as a magnetic field.

We are now in a position to understand why a freely suspended magnet always points north and south. The earth itself acts as a huge magnet having one pole in the north of Canada and the other in the antarctic continent, and a magnet points north and south because of the influence of the earth's magnetic poles upon the poles of the magnet. The earth's magnetic pole in Canada must be regarded as the south pole because it attracts the pole of the magnet that we have agreed to call the north pole.

The peculiarity of a magnet of pointing approximately north and south is made use of in the compass. In its simplest form this consists merely of a magnetised needle pivoted so as to swing freely over a card marked with the points of the compass. This form works well on land but for use on ships a more elaborate arrangement is necessary. In the mariner's compass the single needle is replaced by several thin strips of steel magnetised separately and suspended side by side. These are fastened to the underside of a circular card and suspended in a bowl made of copper, which is a non-magnetic metal. In order to keep this bowl in a horizontal position no matter how the ship may be rolling, it is supported by "gimbals," which consist of two concentric rings attached to horizontal pivots and moving in axes at right angles to one another.

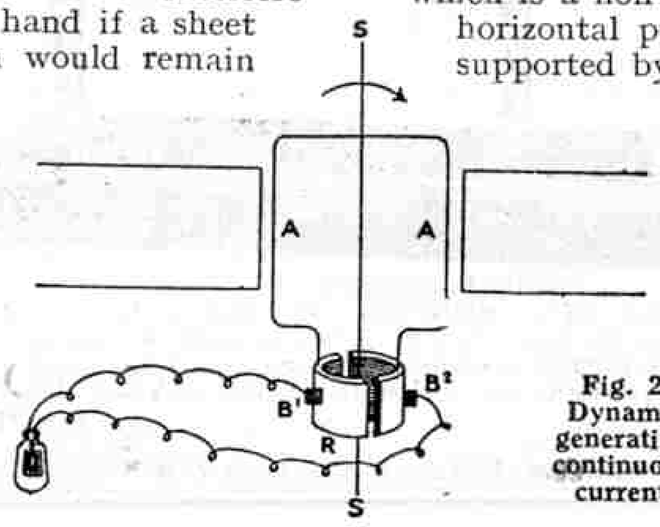

Fig. 2. Dynamo generating continuous current

The compass needle does not point to the true geographical north pole and for practical use it is necessary to know by how many degrees the direction shown by the compass varies from true north. This angle between the magnetic and the geographical meridians is called the "declination," and has been determined by careful survey for places all over the world.

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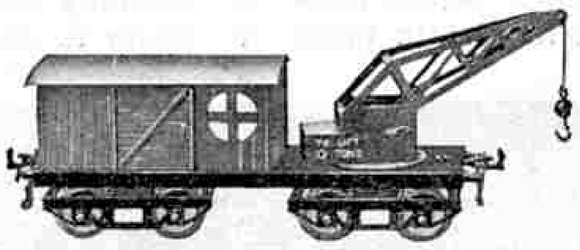

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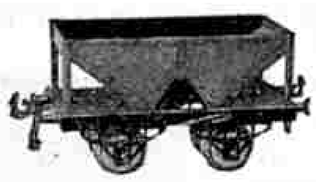

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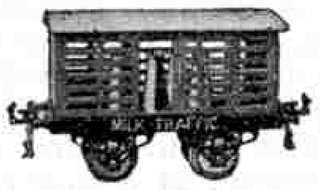

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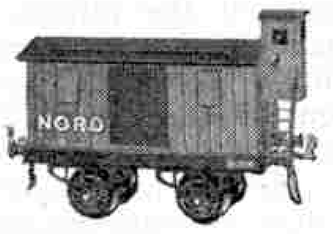

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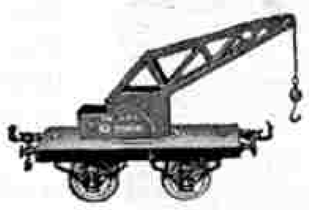

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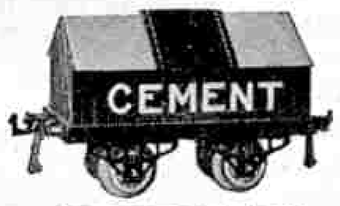
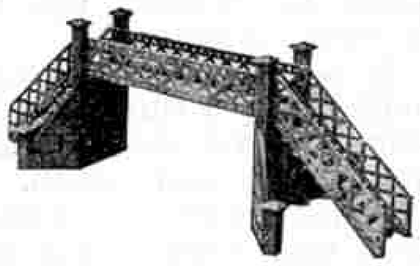
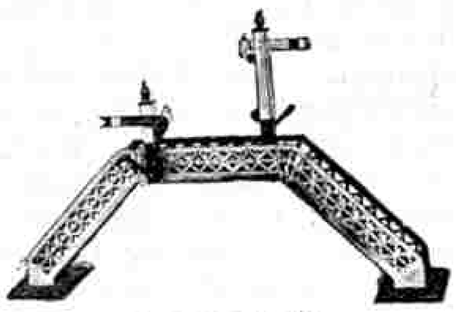


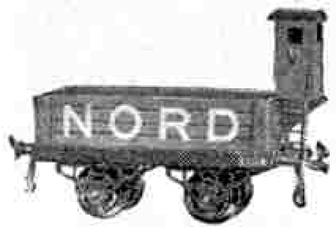
CEMENT WAGON
Finished in grey and black. Price **3/-**



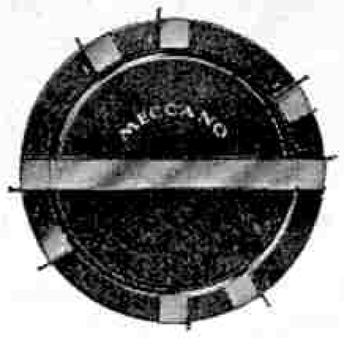
LATTICE GIRDER BRIDGE
Constructional type. Strong and well proportioned. Price **9/6**



FOOTBRIDGE
No. 1. With detachable Signals Price **6/-**
No. 2. Without Signals ... ,, **3/6**
Signals only ... ... per pair **2/9**

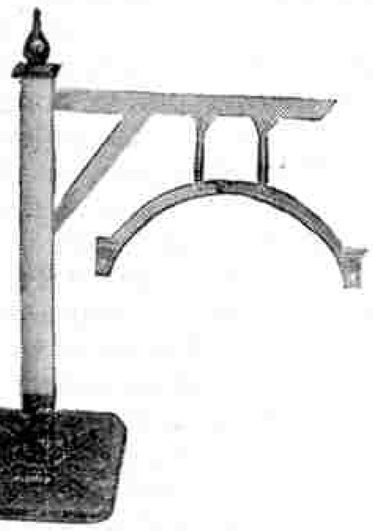


WAGON
French type. Lettered Nord. Highly finished in colours. Price **3/3**



TURN-TABLE
Large Size ... Price **4/-**
Small Size ... ,, **2/6**

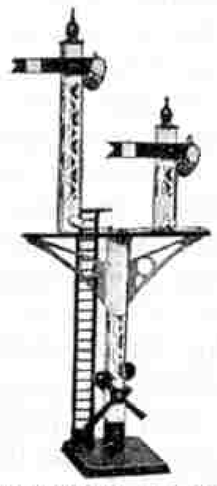
ISLAND PLATFORM
Length 32¼-in., height 6¾-in., width 3-in. The ramps at either end are detachable, and if desired the platform may be connected to the main station. Attractively coloured in green, blue and white ... Price **7/6**
Ramps similar to those fitted to the Island Platform may be purchased separately ... ... Price **9d.** each



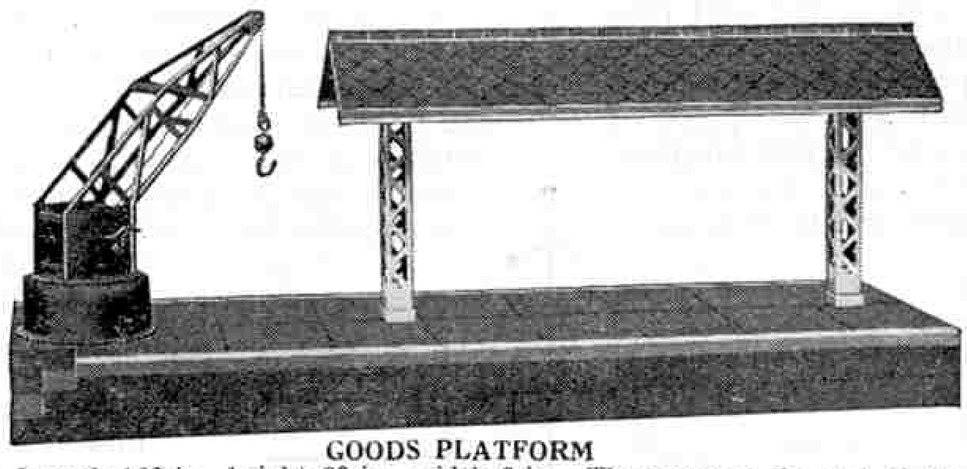
LOADING GAUGE
Price **1/9**

WAYSIDE STATION. A well-made model, richly finished in bright colours. By placing one or more of these Stations at intervals along the track, and using the Windsor Railway Station as the main terminus, a very realistic effect is given to a miniature lay-out. Dimensions: Length 16¾-in., width 6-in., height 9-in. ... ... Price **5/-**

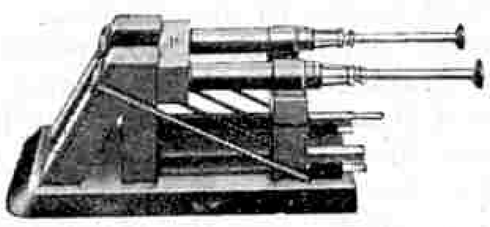
DOUBLE LAMP STANDARD
Four-volt bulbs may be fitted into the globes. Price **4/-**



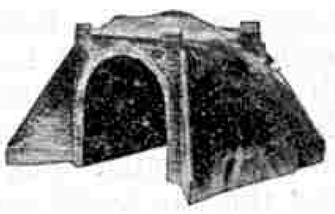
JUNCTION SIGNAL
Signal arms operated by levers at base. Very realistic model standing 14-in. in height. Price **5/6**



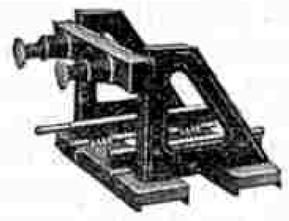
GOODS PLATFORM
Length 16¾-in., height 6¾-in., width 6-in. The crane at the end of the platform revolves on its base. It is enamelled in bright red and is fitted with a crank and ratchet mechanism for controlling the load. The remainder of the platform and shelter is coloured in green, blue and white ... ... Price **10/-**



HYDRAULIC BUFFER STOPS
Price **5/-**



TUNNEL
Realistic and finished in colours ... Price **7/6**



SPRING BUFFER STOPS
Price **1/-**

* *Lettered L.M.S., L.N.E.R. or G.W.*

that exists between electricity and magnetism resulted from a discovery made by a Danish scientist named Oersted who found that when he held over a compass needle a wire carrying an electric current, the needle was deflected to one side or the other. Another connection between the two was discovered by Sturgeon, an English investigator, in 1823, who found that a bar of iron becomes a magnet when it is surrounded by a coil of wire through which electric current is passing. The bar regains its magnetic power only during the passage of the current and loses it as soon as the current is cut off. An arrangement of this kind is known as an electro-magnet and it plays a very important part in electrical mechanisms of almost all kinds, ranging from the electric bell to the giant crane that picks up huge masses of iron or steel, and lets them go again in obedience to the movements of a small switch that controls the current.

Another interesting fact is that a spiral of insulated wire through which a current is flowing shows all the powers of a magnet and, in addition, has the peculiar property of drawing or sucking into its interior a rod of iron. Such a spiral is called a "solenoid" and it has many valuable practical applications.

Sturgeon's investigations led to the even more important discoveries with which the name of the great English scientist Faraday is associated. These discoveries led to the development of the dynamo and the electric motor which to-day play an essential part in industry and transport throughout the world.

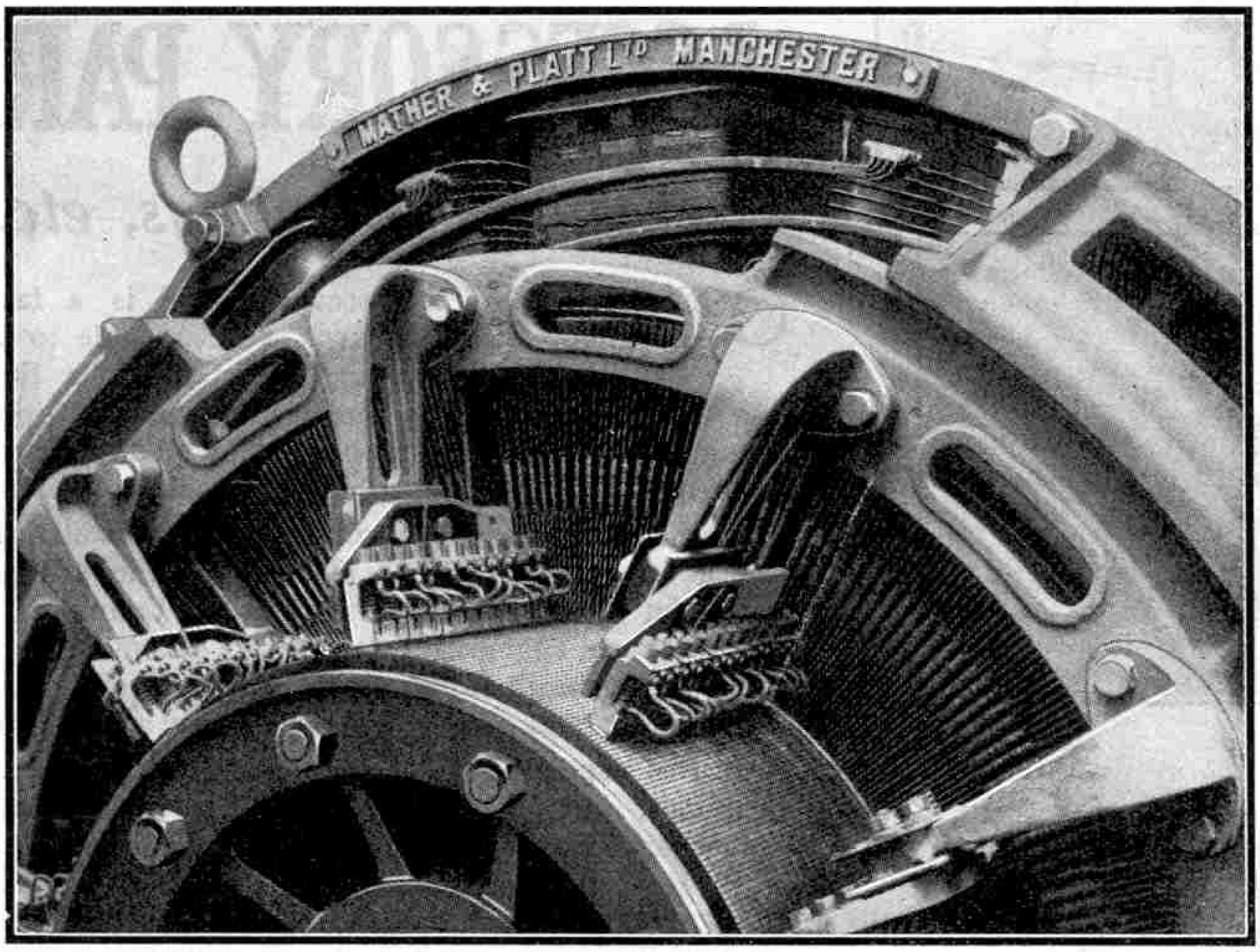


Photo courtesy of] [*Messrs. Mather & Platt Ltd.*

Fig. 3. Close-up view of large dynamo, showing the carbon brushes pressing on the copper segments of the commutator. The poles and their windings are also seen, at the top of the photograph

Faraday discovered that a current of electricity could be produced, or "induced" to use the correct technical term, in a coil of wire either by moving the coil towards or away from the magnet or by moving the magnet towards or away from the coil. A magnet is surrounded by a field of magnetic force and Faraday found that the current was induced when the lines of force were cut across. Making use of this discovery Faraday constructed the first dynamo. He also discovered that if an electric current is passed through a coil of wire suspended freely between the poles of the magnet, the coil revolves and this discovery led to the development of the electric motor.

Fig. 4 is a diagram of a dynamo in its simplest form. Between the poles of the magnet, N and S revolves a coil of wire A^1 A^2, mounted on a spindle SS. This revolving coil is called the "armature." Two insulated rings R R are each connected to one end of the coil, and the brushes B B made of copper or carbon each press on one ring. The current is conducted away from these brushes into the main circuit, where we will suppose it to be used to light a lamp.

Let us assume the armature to be revolving in a clockwise direction. Then A^1 is descending and cutting the lines of force in front of the north pole of the magnet, and so a current is induced in the coil and, of course, also in the main circuit. Passing on its way, A^1 reaches the lowest point of its circle and begins to rise in front of the south pole, inducing another current, but this time in the opposite direction. The general result is to produce a current that reverses its direction every half-revolution, and such a current is called an "alternating" current.

In a dynamo such as our diagram represents there are only two magnetic poles and the current flows backward and forward once every revolution. By using a number of magnets, however, arranged so that the coil passes in turn the poles of each, the current may be made to flow backward and forward several times.

Alternating current is unsuitable for certain purposes, and by making a small change in the dynamo this current may be converted into "direct" or "continuous" current, which does not reverse its direction.

The difference between a direct and an alternating current dynamo lies in the rings, and the new arrangement is shown in Fig. 2. In place of the two rings in Fig. 4 there is a single ring divided into two parts, each half being connected to one end of the revolving coil. Each brush thus remains on one half of the ring for half a revolution and then passes over to the other half. Thus, during one half revolution the current is flowing from brush B^1 in the direction of the lamp. During the next half revolution the current will reverse its direction, but as brush B^1 has now passed over to the other half of the ring, the current is still leaving by it. A moment's thought, therefore, will show that the current must always flow in the same direction in the main circuit, leaving by brush B^1 and returning by brush B^2.

This arrangement for converting an alternating current into a continuous current is called a "commutator," from the Latin *commuto*, meaning "I exchange."

The dynamos used in actual practice are much more complicated than the simple device we have just described. Each one has a set of electro-magnets, and the armature consists of many coils of wire mounted on a core of iron, which has the effect of concentrating the lines of magnetic force.

The electro-magnets in a dynamo require a current to be flowing through their windings before they acquire magnetic powers. A continuous current dynamo starting for the first time has its electro-magnets supplied with current from an outside source, but afterwards the dynamo will always be able to start again because the magnet cores retain sufficient magnetism to set up a weak magnetic field. The repeated cutting of the feeble lines of magnetic force sets up a weak current which, acting upon the magnets, gradually brings them up to full strength. Once the dynamo is generating current it continues to feed its magnets by sending through them either the whole or part of its current.

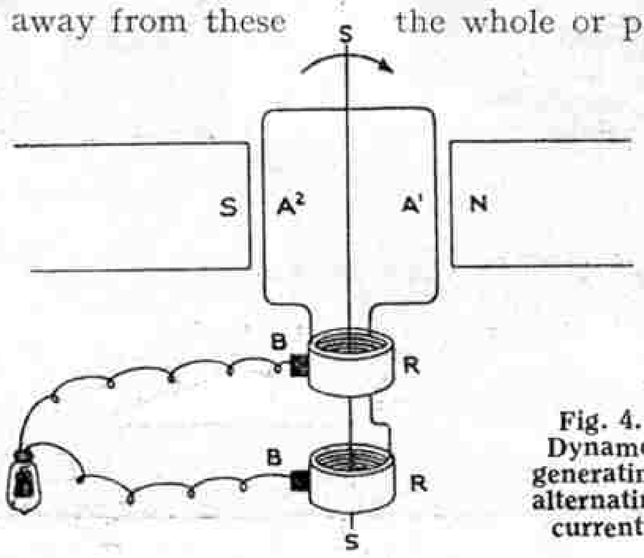
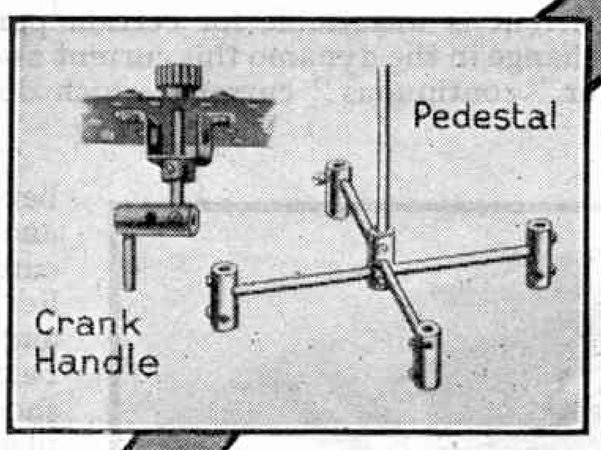


Fig. 4. Dynamo generating alternating current

What has just been said applies only to continuous current dynamos. An alternating current dynamo cannot feed its own magnets, and these are supplied with current from a separate continuous current dynamo, which may be of quite small size.

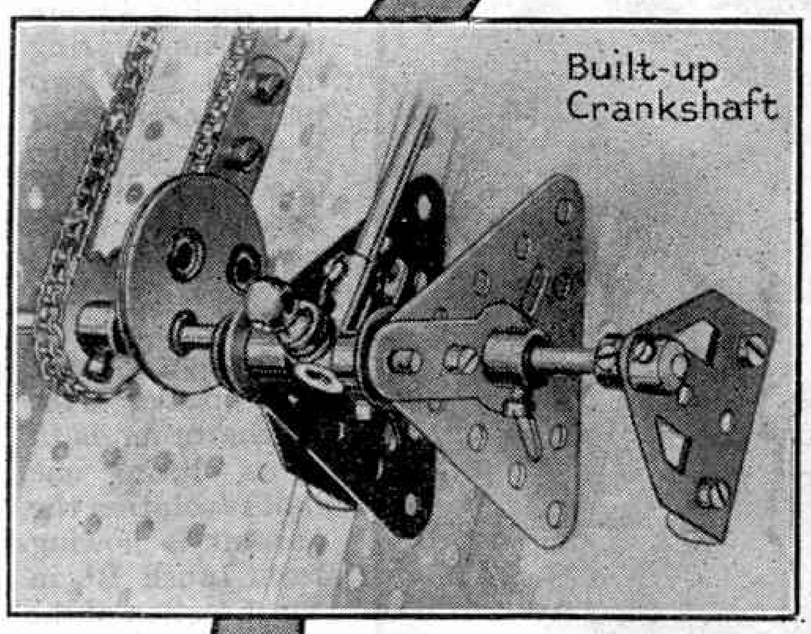
Bearing in mind what we have learned about the principle on which the dynamo works, it is quite easy to understand the principle of the electric motor. Suppose, for instance, we wish to use as a motor the dynamo illustrated in Fig. 2. First of all we take away the lamp and substitute for it a second continuous current dynamo. We (*Continued on page* 1097)

MECCANO — ENGINEERING IN MINIATURE



MECCANO ACCESSORY PARTS

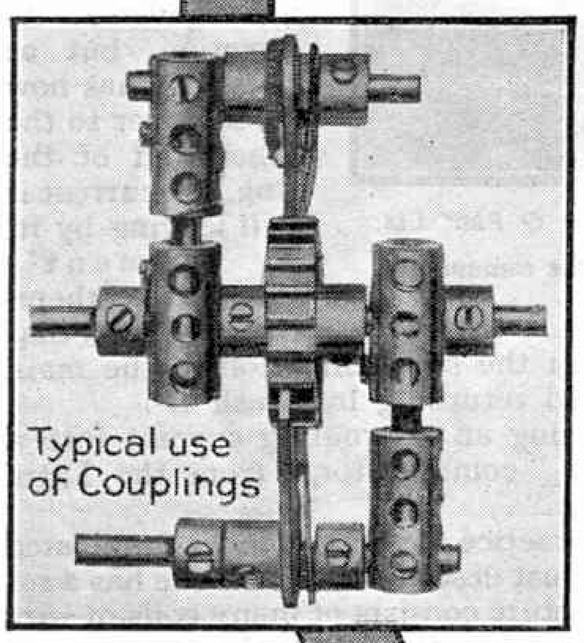
Cranks, Couplings, etc.



CONSTRUCTING a Meccano model is a fascinating pastime. Piece by piece, you are able to watch it growing beneath your hands. As the Strips fall into their allotted places the whole structure is gradually strengthened. The framework completed, you add the mechanism—Gears, Cranks, Rods, Pulleys, Cords, etc.

Then comes the most thrilling moment of all, when you set the model in motion. Thanks to the accuracy and wonderful adaptability of the Meccano Couplings, Cranks, and other real engineering accessories, the movable portions of the model begin to function exactly as you had intended they should, and exactly as they do in actual practice.

On this page we show a few uses of Meccano Cranks and Couplings, but—as *"M.M."* readers know—the number of mechanical movements that may be obtained with these parts is almost unlimited.

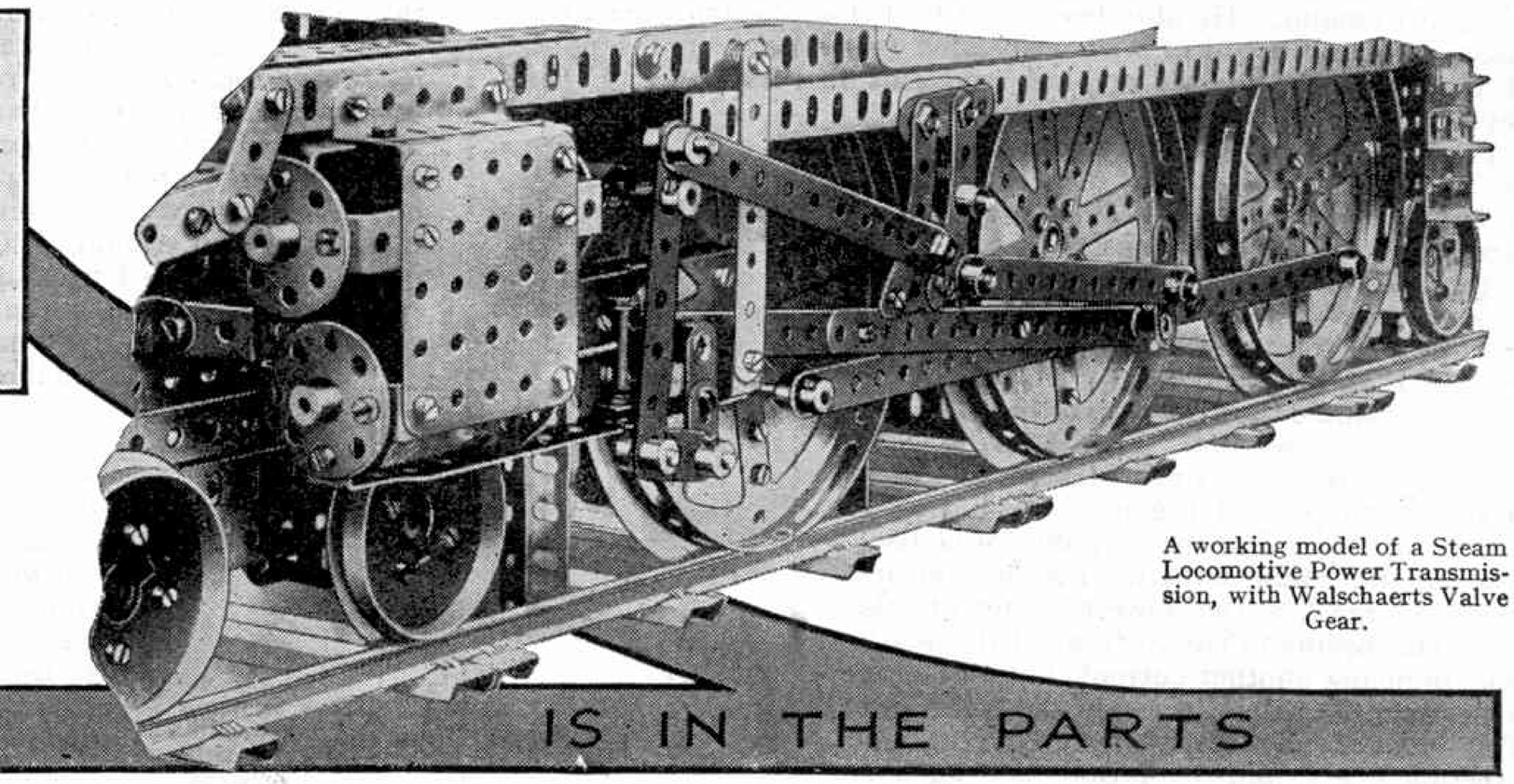


No.			s.	d.
19.	Crank Handles, large	each	0	3
19s.	Crank Handles, small	,,	0	3
50a.	Eye Pieces, with boss	,,	0	3
57.	Hooks	,,	0	1
57a.	,, (scientific) ...	,,	0	1
57b.	,, (loaded) ...	,,	0	5
59.	Collars with set screws	,,	0	2
62.	Cranks...	,,	0	3
62a.	Threaded Cranks ...	,,	0	4
62b.	Crank with centre boss	,,	0	3
63.	Couplings	,,	0	6
63b.	Strip Couplings ...	,,	0	8
63c.	Threaded Couplings ...	,,	0	6
64.	,, Bosses ...	,,	0	2

No.			s.	d.
65.	Centre Forks	each	0	2
115.	Threaded Pins ...	,,	0	2
116.	Fork Pieces	,,	0	3
120.	Buffers, for locos, etc.	,,	0	2
120a.	Spring Buffers	per pair	0	8
121.	Train Couplings ...	each	0	2
127	Simple Bell Cranks ...	,,	0	3
128.	Boss Bell Cranks ...	,,	0	4
134.	Crank Shafts, 1" stroke	,,	0	3
136.	Handrail Supports ...	,,	0	3
140.	Universal Couplings ...	,,	0	9
144.	Dog Clutches	,,	0	6
165.	Swivel Bearing ...	,,	0	6
166.	End Bearing	,,	0	3

Your dealer will be pleased to show you all the Meccano Parts; ask him for a complete Price List.

MECCANO LTD., BINNS ROAD, LIVERPOOL



A working model of a Steam Locomotive Power Transmission, with Walschaerts Valve Gear.

THE GENIUS IS IN THE PARTS

In these columns we reply to suggestions regarding improvements or additions to the Meccano and Hornby Train systems. We receive many hundreds of such suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on separate sheets of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Liverpool.

Suggested New Meccano Parts

LONGER COMPRESSION SPRINGS.—We were interested in your suggestion regarding the introduction of longer Compression Springs, but we do not think that your proposed part would have any great advantage over the existing Spring, No. 120b. The occasions on which it could be used would probably be rare. (*Reply to D. Weston, London, N.*10).

GRUB-SCREWS IN PULLEYS, ETC.—We have not found many occasions where it has been necessary to substitute Grub-screws for the ordinary Set-screws supplied in the majority of the Pulley Wheels, etc. A better grip on the axles can be obtained with the Set-screws and on the few occasions when their heads are likely to foul the adjacent mechanism, it is a simple matter to substitute a Grub-screw. (*Reply to H. Hatch, Three Rivers, Ontario*).

CORNER ANGLE BRACKETS.—You will be interested to know that the new Corner Angle Bracket may be obtained in both right-hand and left-hand types, as indicated in the special announcement on this page. (*Reply to S. Riley, Stowmarket*).

CURVED ANGLE GIRDERS.—Curved Angle Girders supplied in short lengths would have a limited application we fear, but we have noted your suggestion for further consideration at a later date. (*Reply to A. Godder, Canterbury*).

BRAKE BANDS.—We think that a special band for external contracting brakes is scarcely necessary, as the functions of such a part are easily covered by cords or even Meccano Strips. See the various types of brakes described under Section VI of the Standard Mechanisms Manual. (*Reply to A. Godder, Canterbury*).

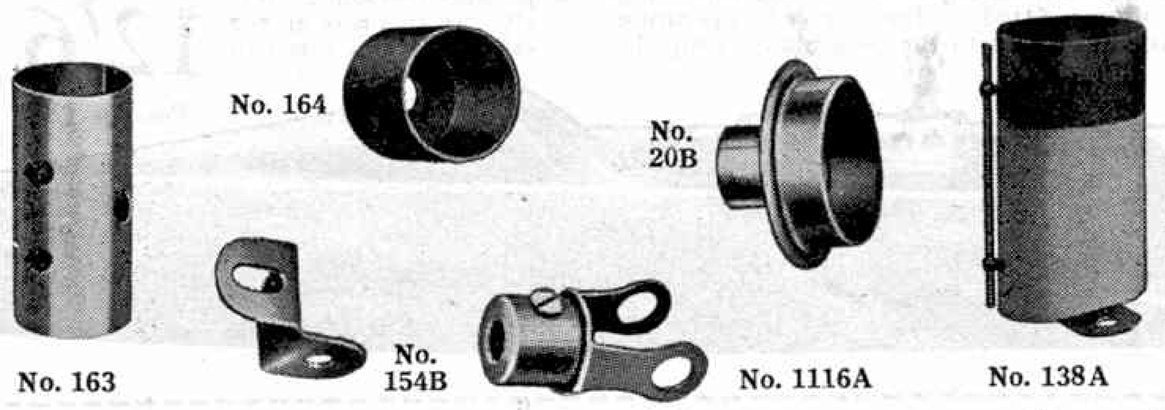
LUBRICATING CUPS.—We are very interested in your suggested oil cup for insertion in journal bearings formed from the bosses of Cranks or Meccano Wheels, etc. We agree that such an accessory would form a very attractive addition to many models, and we shall give the idea very careful consideration. Meanwhile, we may point out that where bearings of the type indicated above are used, the threaded bores of the Cranks, etc., form useful receptacles to receive the oil. These receptacles may be closed after the oil is applied by screwing a Handrail Support or other similar part into the threaded bore. (*Reply to S. Holyoak, Coventry*).

CORRUGATED PLATES.—We agree that the addition of corrugated steel plates to form roofs for cranes and similar models would prove very effective, but we fear that such accessories would not conform with the existing Meccano system. (*Reply to A. Custance, Woodbridge*).

NEW DOUBLE ANGLE STRIPS.—We will give further consideration to the question of introducing 1″×½″ and 1″×1″ Double Angle Strips. (*Reply to D. H. Williams, Ipswich*).

TRIPLE-ANGLE STRIPS.—We note your suggestion regarding a part resembling a Double Angle Strip bent at right angles at its centre. We fail to see that such a part would be of much use, however. Two Double Angle Strips bolted together would fulfil the same functions admirably. (*Reply to J. Stephens, Edinburgh*).

MORE MECCANO ACCESSORIES



The new parts shown above are the latest additions to the Meccano system. They make possible the construction of numerous new models and should improve the appearance and operation of many of the existing models. The particulars of the parts are as follows :—

No. 20b, Flanged Wheels, ¾″ diam., price 4d. These may be used as travelling wheels in all models that are required to run on rails, but they are particularly suited for use as bogie wheels in locomotives, etc. In addition they are designed to fit over the end of the Sleeve Piece (part No. 163) to form a complete cylinder unit. They also form excellent belt pulleys, especially if two are butted together on an Axle.

No. 116a, Fork Piece, small, price 3d. This part is designed for pivotal connections between Rods and Strips. Owing to its smaller design it lends itself to adaptations not possible with the existing Fork Piece (part No. 116). For example, it forms an excellent bearing for a ½″ loose Pulley for use in connection with electric trolley arms, etc. ; the Pulley should be journalled on a ½″ Bolt passed through the Fork, and the boss of the latter should be secured to the end of a convenient Axle Rod.

No. 138a, Ship's Funnel, Cunard Type, price 6d. This part is of different design from the existing Ship's Funnel (part No. 138) and is designed primarily for use in model liners and other Meccano vessels. It is oval in shape, raked, and is fitted with a miniature steam pipe. It is enamelled red with black top, after the pattern adopted by the famous steamship line.

No. 154b, Corner Angle Bracket, left-hand, price 6d. per half dozen. This is a companion part to the Corner Angle Bracket illustrated in the October "*M.M.*," and like that part, is designed for use in cases where two ½″×½″ Angle Brackets bolted together would prove either too cumbersome or insufficiently rigid. The bracket previously announced will be known as the " right-hand " type and will bear the number 154a instead of 154.

No. 163, Sleeve Piece, price 6d. per pair. This part measures 1⅜″ in length by ½″ in diameter. Fitted with a ¾″ Flanged Wheel at each end, it forms an excellent cylinder. Two or three Sleeve Pieces may be used to build up a chimney or length of hollow shafting, etc.

No. 164, Chimney Adaptor, price 2d. This is in the form of a small cylinder closed at one end except for a hole of standard size, with the aid of which the adaptor may be bolted to any Meccano part. This accessory forms a suitable chimney for model locomotives, etc.

LARGE FLANGED PLATES.—The uses of your suggested large Flanged Plate with flanges formed on the ends only are covered already by the Plates already included in the Meccano system. We do not think that we should be justified in bringing out such a part as you suggest. (*Reply to D. Weston, London, N.*10).

HOLES IN LARGE BEVEL GEARS.—You will be interested to know that since our announcement in the October "*M.M.*," it has been decided to include eight holes in the face of the 1½″ Bevel Gear (part No. 30c). This improvement will increase the adaptability of the part to a considerable extent, as you point out. (*Reply to P. Graham, Avening, Glos.*)

RATCHET SPANNER.—We were very interested in your proposed ratchet spanner. It is certainly a very good idea but we fear that it would be rather difficult and expensive to manufacture. We find that the present type of spanner is suitable for all the requirements likely to arise in Meccano model-building. (*Reply to D. Davies, Cwngwrack, Glam.*)

LAMP HOLDER.—We were interested in your suggested new lamp holder, consisting of a screw holder, to take standard 4-volt bulbs, on a shaped metal base. We think, however, that in most cases the existing Meccano Lamp Holder (part No. 310) can be used in place of your proposed accessory. (*Reply to J. Martin, Glasgow*).

LONGER WINDING KEY.—We note your suggestion re a longer winding key for the Clockwork Motor, but we do not think that much advantage would accrue from its adoption. By the exercise of a little ingenuity the Motor can, in most cases, be put in an easily accessible position on the model. (*Reply to P. Hollings, Northchurch, Herts.*)

NEW REVERSED ANGLE BRACKETS.—Your proposed 1″×½″×½″ Reversed Angle Bracket is interesting but hardly worth while including in the Meccano system as a new accessory. We think that you should find it a simple matter to contrive such a part from the existing Reversed Angle Bracket with the addition of a Flat Bracket bolted rigidly in the desired position. (*Reply to A. Jones, London, N.W.*1).

NEW DOUBLE ANGLE STRIP.—A 1½″×1″ Double Angle Strip may easily be built up from existing parts. Two 1″×½″ Angle Brackets bolted securely to a 1½″ Strip should serve the purpose admirably. (*Reply to P. Graham, Avening, Glos.*)

WIRE STAYS.—We are very interested in your suggestion that wire rods should be manufactured in different lengths for use as stays in roofs of buildings, such as stations, etc., and in bridges, aeroplanes, and similar models. We will bear the idea in mind. (*Reply to N. S. Dunn, Kingston*).

MECCANO TOOL.—We have noted your ideas concerning a Meccano tool of circular or square section, for use in model machine tools. We are keeping a careful record of all suggestions bearing on this subject, and later we shall be able to judge as to the advisability of introducing such a part into the Meccano system. (*Reply to A. Staveley, Swinton*).

MECCANO MOTOR IMPROVEMENT.—We have noted your suggestion regarding the extension of the Meccano Electric Motor armature spindle through both side plates of the Motor. We hope to adopt this idea in the near future. (*Reply to E. Rawlings, Westmount, Canada*).

NEW FLAT PLATES.—We are not in favour of your proposal regarding the supply of Flat Plates 1½″ in width and in various lengths, for these parts could easily be built up from existing accessories, such as Flat Girders. (*Reply to D. Williams, Ipswich*).

DISCS FOR MOTOR CAR WHEELS.—Your proposed disc, specially shaped to fit on to the 3″ Pulley Wheels when the latter are used as motor car wheels, is scarcely suitable as a Meccano accessory, since its uses would be very limited. (*Reply to A. Custance, Woodbridge*).

HOBBIES
MODEL LAUNCHES AND ENGINES

The STEAM TUG

Length 29½ ins.
Beam 4½ ins.

Because of the popularity of our original Steam Tug model, we have introduced an improved pattern launch of the same type. The funnel and mast are detachable for packing, but easily erected when required. The engine is strong and rigid, and drives direct to the propeller shaft. There is no danger from the lamp because the spirit reservoir is kept away from the flame, whilst a safety valve is fitted to the boiler.

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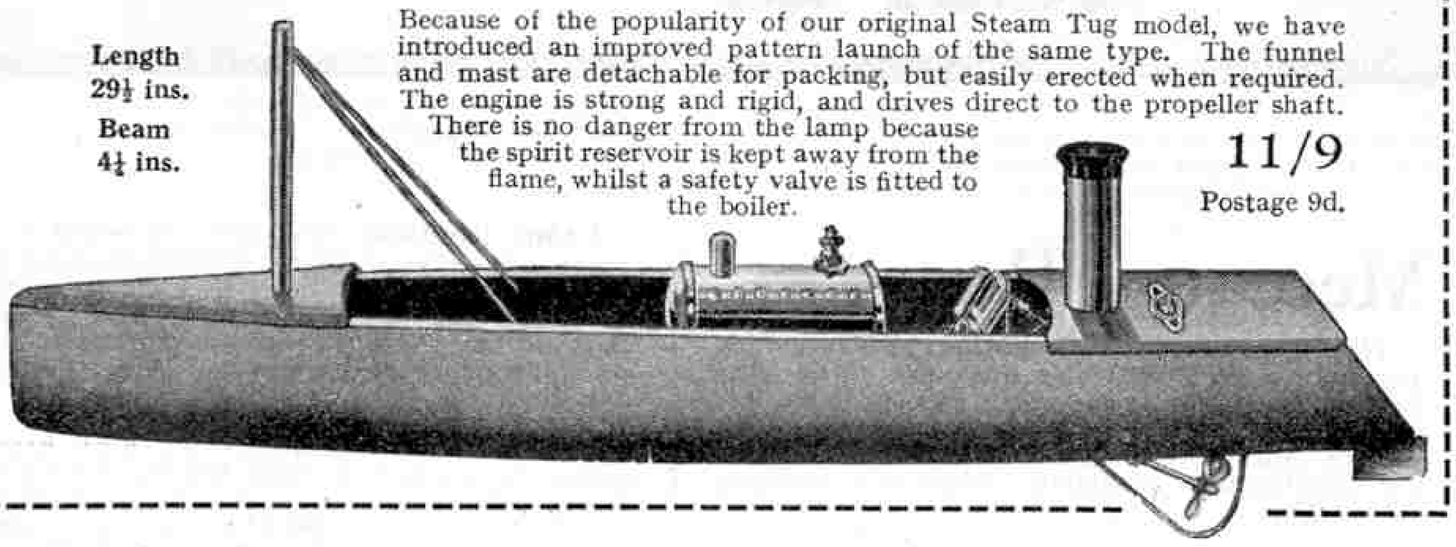

Hobbies Launches are already known all over the world, and thousands of Meccano boys have had hours of sport with them. They are the real thing, with beautiful hulls and strong brass engines. What could you desire more for Christmas? See that Dad knows you want one!

MISS AMERICA

Length 30 ins.
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One of the most popular of our launches. Its pleasing lines, well finished hull and strong engine, together with its low price, have been the means of selling it wherever a calm lake or river was available for the sport it created. The brass boiler is totally enclosed, and the steam super-heated to produce efficient power. The engine is of brass fitted by direct drive to the propeller shaft. In this way all the power is transferred direct to the twin-bladed propeller. A safety valve is fitted to the boiler.

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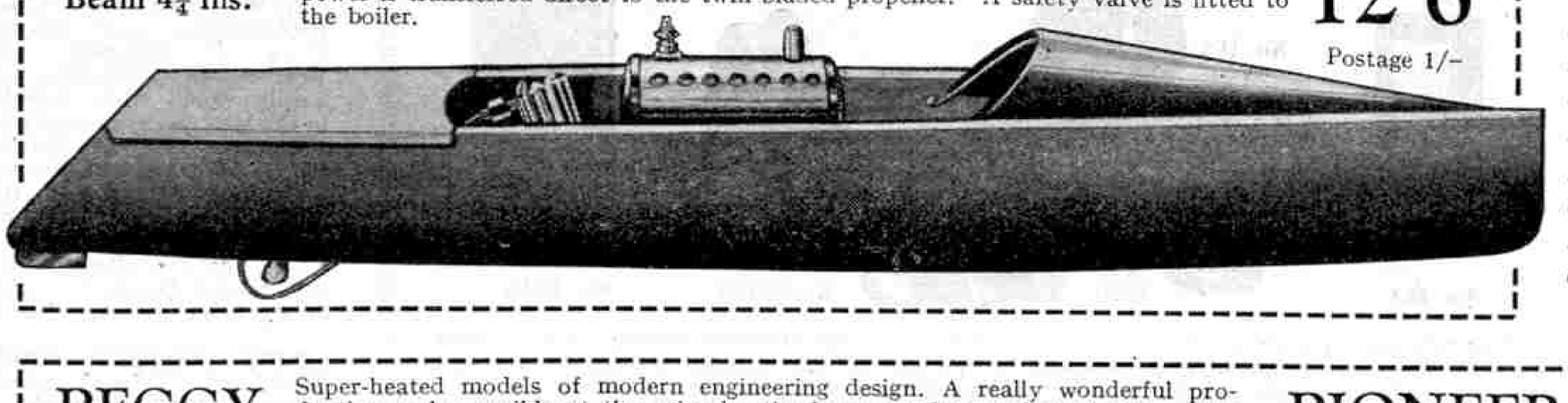

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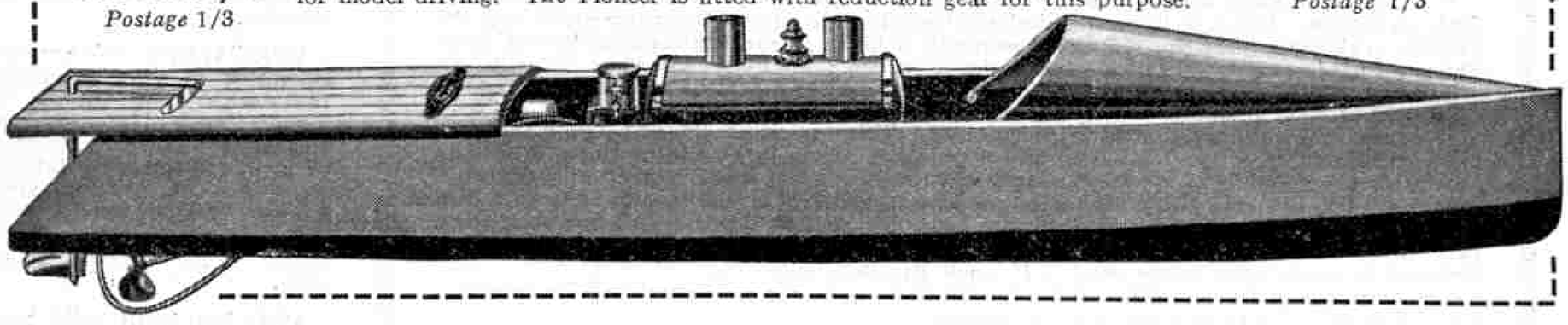

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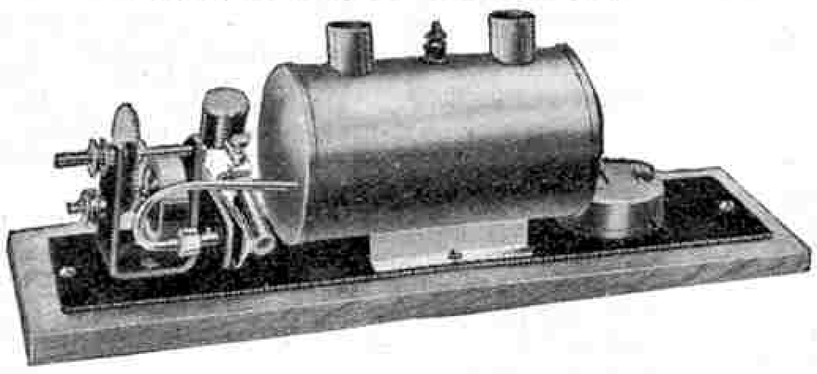

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Suggested Hornby Train Improvements

0-4-4 TANK LOCOMOTIVE.—Your proposed 0-4-4 Tank Locomotive is very interesting but we doubt whether it would form a desirable addition to the Hornby System. We are obliged to keep the number of different types of engines within reasonable limits, and we consider that there are several more popular types to be considered before we can introduce a locomotive of the kind that you suggest. (*Reply to G. Allen, Brisbane*).

ACCUMULATORS IN TENDERS.—We are interested in your suggestion regarding the possibility of mounting an accumulator in the tender of an electrically-driven locomotive, which would thus be converted into a self-contained power unit carrying its own source of energy about with it, but we fear that the idea is scarcely practicable owing to the very heavy weight that the engine would be required to pull. Moreover, the present system of power transmission by "live" rails permits of the trains being controlled from switches outside the track, which adds considerably to the interest of a railway. (*Reply to J. Bompas-Smith, Manchester*).

TOOLS FOR BREAKDOWN VAN.—We are interested in your suggestion that we should produce tools for use in connection with the Breakdown Van and Crane, but we fear that if accessories of this kind were manufactured to the Hornby scale they would prove very unsatisfactory. Such minute items would easily be lost or broken. (*Reply to F. Marquand, Woodville, N.Z.*)

LEVERS ON CROSSOVERS.—We note your suggestion that the Crossovers should be available with the operating levers on either side of the rails. We regret, however, that the inconvenience and complications that would be caused by the proposed change would not be justified by the advantages that are likely to accrue from your suggestion. (*Reply to K. Hipperson, Tavershan*).

SINGLE SLIP.—Your proposed combined points and crossing is known in actual practice as a single-slip crossing, which consists essentially of a crossing incorporating turnout points, whereby the train may be deflected in a certain direction. Examples of these crossings may be seen in large stations, where the "double slip," a more complicated type of rail, may also be seen. Your suggestion is certainly very good and doubtless might be incorporated with advantage in some of the more complicated Hornby layouts. Rails of this kind would prove somewhat expensive to manufacture, however, and much experimental work would be necessary to enable us to pronounce a verdict on your suggestion. We shall be interested to hear from any other readers who are ready to support the idea. (*Reply to F. R. Martin, Southampton*).

No. 2 TANK PULLMAN SET.—We do not think that there would be much point in introducing a new set comprising a Pullman train hauled by a No. 2 Tank Loco. We find that most Hornby enthusiasts prefer to use the tender locomotives for this purpose, and when a tank set is specially required the various components may be bought separately at very little extra cost. (*Reply to J. Robins, Isfield, Sussex*).

MIXED TRAIN SET.—A locomotive hauling one Pullman Coach and an assortment of goods trucks would look rather out of place on a Hornby layout and even, we think, on a real railway. We do not believe there would be a great demand for the introduction as a complete train set of such an unusual combination of rolling stock. (*Reply to J. Smith, London, S.E.*)

GOODS DEPOT.—We would point out that a Goods Depot is already included in the Hornby system. It is a realistic model of a typical loading platform, and is fitted with a working rotating crane. We think the majority of Hornby enthusiasts will find that this accessory will suit their requirements admirably. (*Reply to R. Smith, Hythe*).

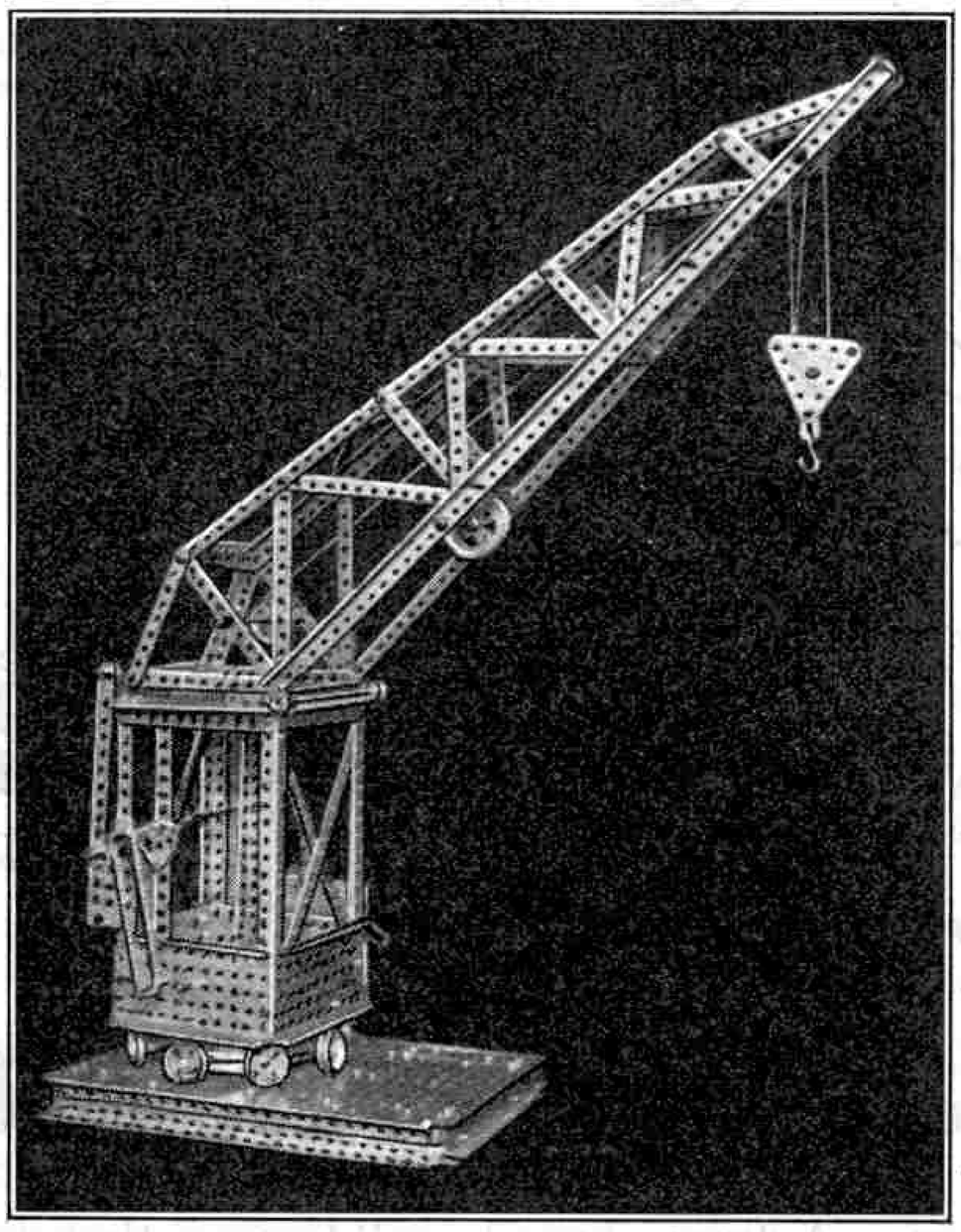
TRANSFORMERS FOR A. C. MAINS.—We have received a number of requests for the introduction of transformers specially designed for reducing electric house supply circuits (alternating current) to the correct voltage for the Hornby 4-volt Trains and Meccano Motors, and we hope to introduce suitable transformers in the near future. (*Reply to J. B. Newton, Manchester*).

DETACHABLE BODY FOR VAN.—We are interested in your proposal regarding the introduction of a luggage van body painted to represent a furniture removal van, etc., which could be lifted on or off a flat truck by means of a crane. We shall give your idea further consideration. (*Reply to E. Dalrimple, Bradford*).

ATTACHMENT FOR SLIPPING COACHES.—Your suggestion that a device should be attached to the rear of certain coaches, so that a portion of a Hornby train could be slipped while in motion, is a good one. We have been engaged for some time past in experiments with a view to introducing a device of this kind, but there are still many difficulties to be overcome. (*Reply to B. Morris, Whitchurch*).

SIGNAL GANTRY.—As previously pointed out in these pages, we are making a note of all suggestions submitted on this subject. Meanwhile it should be quite a simple matter to make a very realistic gantry with Meccano parts and using the new Signal Arm, which was illustrated in the November "*M.M.*" Any number of signals could be provided, and the model would therefore be adaptable to almost any layout. It will be remembered that the Meccano Signal Arm can be obtained in both "home" and "distant" types (parts Nos. 158a and 158b respectively). (*Reply to J. Gibbs, and H. Vigors, Malvern Wells*).

A PRIZE-WINNING CRANE



This excellent model of a heavy pontoon crane secured Third Prize in the 1926 Meccano "Crane" Model-building Competition for Mr. L. W. Grey, of Kempton Road, East Ham, E.6. The model is practically a scale reproduction of a giant crane recently built by a famous Dutch firm of engineers, and the various movements of the prototype are reproduced in a most realistic manner. An additional pulley block for exceptionally heavy loads may be suspended from the 2" Pulleys shown attached to a point in the underside of the jib, a little less than midway along its length.

LAMPS FOR STATIONS, ETC.—We are keeping a careful record of all suggestions received dealing with the illumination of stations and signal cabins by means of miniature electric lamps. We doubt whether the innovation would prove popular, however, on account of the increase in cost that it would necessitate. If lamps are required particularly in the Hornby stations, etc., it should be a simple matter to fix up the necessary lamps and connections with the aid of the Meccano electrical accessories. Platforms may be lit most realistically by means of the existing Hornby Single and Double Lamp Standards. (*Reply to M. Milligan, Wellington, N.Z.*)

SIGNALS FOR POINTS.—We note your suggestion regarding the provision of small electric lamps at points and crossings, etc., to indicate by means of coloured lights the position of the points. Although this idea is interesting we fear that such an article would show to advantage only in a darkened room. We feel sure that few Hornby enthusiasts would care to operate their trains in the dark! (*Reply to J. V. H. Cookson, Bury*).

STEEL RAILS AND WOODEN SLEEPERS.—The cost of production of a miniature permanent way of the type that you suggest, with steel rails secured to wooden sleepers, would be tremendous when compared with the present Hornby track, and we regret we are unable to adopt your suggestion. (*Reply to J. Bompas-Smith, Manchester*).

BOGIE TRUCK FOR GRAIN TRANSPORT.—We are interested in your suggestion that a grain transport truck, similar to that shown on page 169 of the April 1925, issue of the "*M.M.*," should be added to the Hornby system. Such a truck is of a very special character, however, and we do not think that it would prove as popular as one which is in more universal use. (*Reply to J. E. L. Wahl, Johannesburg*).

TWO-SPEED GEARS FOR LOCOMOTIVES.—We have received many suggestions regarding the fitting of two-speed gears to Hornby locomotives but we fear that they are impracticable. (*Reply to A. Black, Johannesburg*).

IMITATION COAL.—Your suggestion re the addition of imitation coal to the Hornby tenders is interesting, but so far the demand has not been sufficient to warrant its adoption. We shall keep the idea in mind, however. Meanwhile those readers who wish to represent coal in the tenders may easily obtain the desired effect by taking a piece of cardboard of the size and shape of the inside of the engine tender and coating it with gum or other adhesive. Coarse coal dust should then be sprinkled over the cardboard and the latter fixed in the tender. When the gum dries a most realistic finish will be given to the tender. (*Reply to T. Renshaw, Manchester*).

POINTS FITTED FOR HORNBY CONTROL.—Your suggestions to the effect that all Hornby points should be obtainable fitted for operation by means of the Control System have been noted. We hope to extend the Control System gradually in the future, and no doubt the Crossovers, etc., will eventually be introduced fitted for Control operation. We may mention that the Electrical 2 ft. radius turnout Points (both right and left-hand) are already available adapted for Hornby Control operation. (*Reply to O. S. Jacobs, Greenwich, and F. Grant, London, S.E.*)

SHUNTING LOCOMOTIVE.—With regard to your suggestion concerning a small shunting locomotive, would not the existing No. 1 Tank engine answer your purpose? We fail to see that a special shunter would arouse sufficient general interest to warrant its manufacture. (*Reply to J. Williams, Prenton*).

HORNBY TRAMCAR.—We are not in favour of the introduction of a model tramcar to run on the Hornby electric rails, as this would have no connection whatever with the Hornby miniature railway system. A model of this type may easily be constructed from Meccano parts. (*Reply to A. Durose, Luton*).

SNOW PLOUGH.—We do not think that your proposed snow plough attachment for Hornby locomotives would prove very popular. We believe we are correct in stating that snow ploughs are generally carried on separate vehicles and are directly attached to the locomotive in exceptional cases only. (*Reply to E. Potten, Braintree*).

BREAKDOWN LOCOMOTIVES.—We are interested in your suggestion regarding a breakdown locomotive consisting of a 2-4-2 tank engine complete with a crane. The cost of manufacture of such an article would be very great, however, and we doubt whether the demand for such an accessory would justify the expense. (*Reply to L. Colin, Outtrim, Melbourne*).

HORNBY GARRATT LOCO.—We agree that a miniature "Garratt" type locomotive would make an interesting addition to the Hornby system, but the objections outlined above regarding the breakdown locomotive also apply to this proposal. (*Reply to Morris Davies, Huddersfield*).

HORNBY CUTTING.—We were interested in your suggestion for a railway cutting for use in Hornby layouts. We doubt whether the idea would prove particularly popular, however, for the type of cutting required varies with almost every layout, and most Hornby enthusiasts prefer to construct accessories of this kind for themselves. (*Reply to M. Milligan, Wellington, N.Z.*)

"There's "Force" behind that!

Five minutes to go. A draw—but no!

"Well hit, sir"—straight as a die. Yes—goal!

Jim's forceful hitting is amazing. His consistent energy a source of delight to his team and to himself.

Jim keeps himself fit. He knows the value of good food. He eats "Force" daily.

"Force," that delicious and nutritious food—served with hot milk this cold weather—sets Jim in trim for a day's work or play, and makes him fit as a fiddle.

You should resolve now to follow Jim's example. Join the throng of broad-shouldered fellows who follow "Sunny Jim" on the road to health and strength. Start to eat "Force" to-day. Grocers sell it.

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MALTED AND TOASTED

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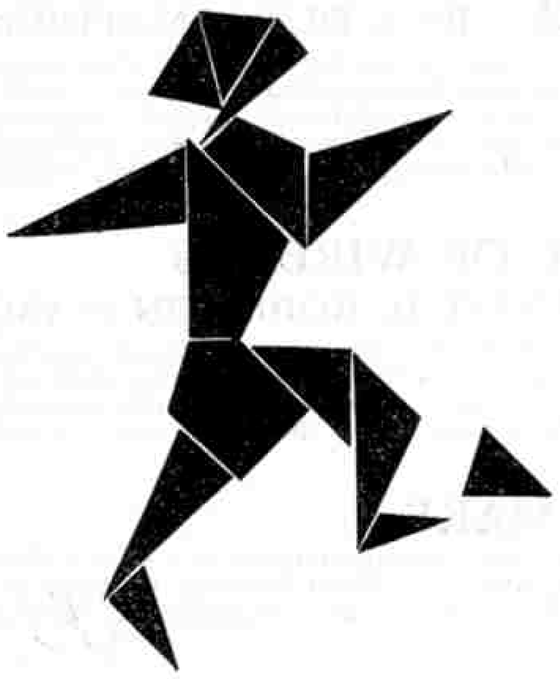
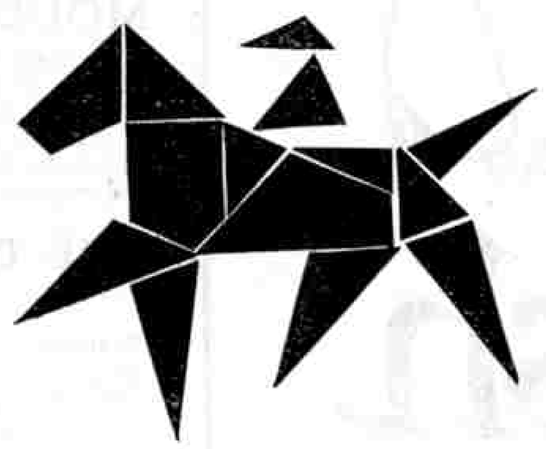
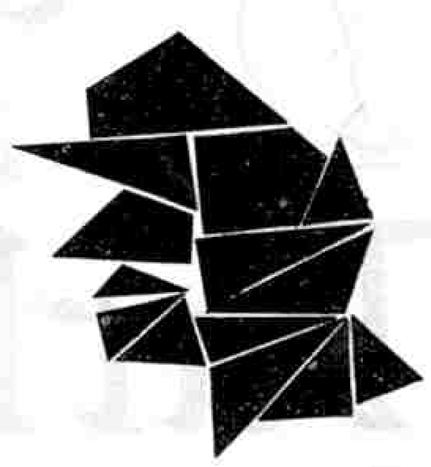
Competition Page



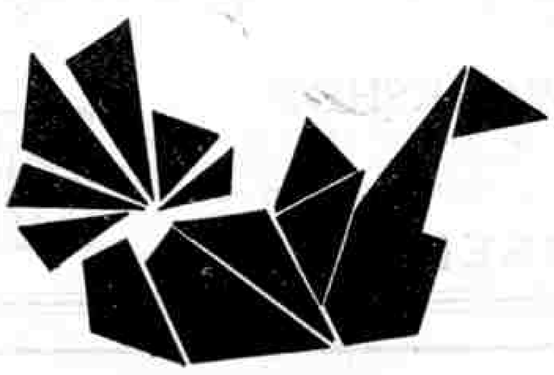
A FOOTBALLER



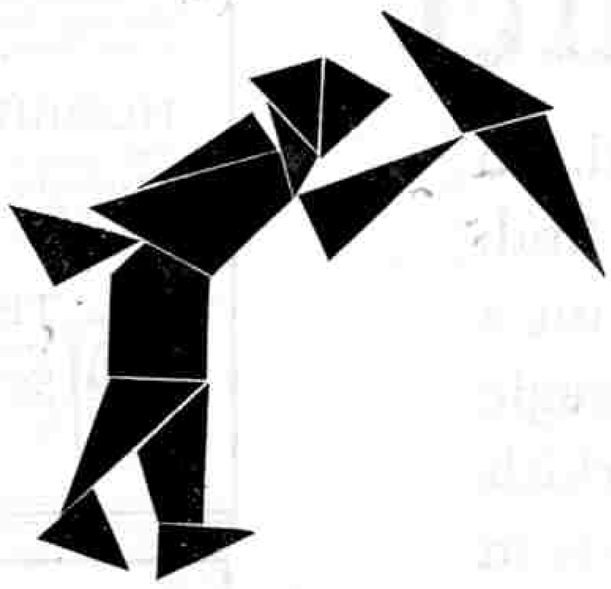
A DERBY WINNER



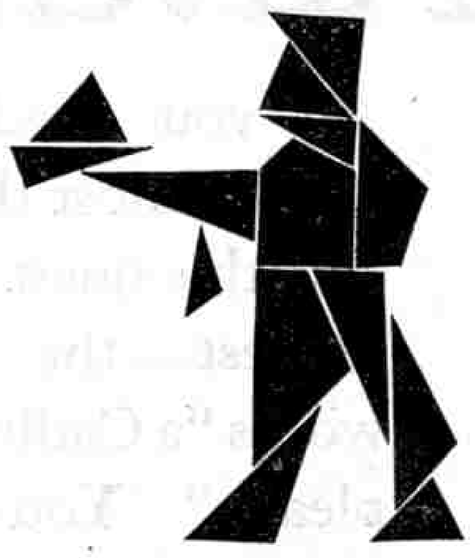
A POSTMAN(!!!)



A ROOSTING TURKEY



RAINY WEATHER



A WAITER

The Stomachion Puzzle

One of the oldest and most fascinating puzzles the world has ever known was invented by Archimedes, the famous Greek mathematician, who lived in the 3rd century. This puzzle is known as the Stomachion, which means, the thing that drives one wild. It is played with 14 small pieces of wood or cardboard. The 14 pieces can be re-arranged in form to produce an endless variety of figures—men, ships, birds, buildings and so on.

The figures illustrated on this page give some idea of the possibilities. It is one of the most exasperating features of the Stomachion that the majority of the game's masterpieces are discovered by accident. One may set out to build a donkey and possibly finish up with an excellently conceived greyhound! As a certain degree of proficiency is reached it is possible deliberately to introduce expression into the faces of the figures. It is possible even to make caricatures of well-known people and we have seen some excellent likenesses of Lloyd George, Charlie Chaplin and Mack Sennett.

The making of the pieces is a very simple matter. First mark out a rectangle on a piece of wood or stiff card, the length being exactly twice as long as the width. The actual dimensions do not matter so long as they bear the 2 : 1 relationship. Now follow carefully the diagram shown here. (A set square will prove very useful at this stage). Having marked the rectangle, A, B, C, D, find, mark and join the centre points (E and F) of the two long sides. Then draw three diagonals; from E to C, E to D, A to D. Now mark the centre points of the diagonals EC and ED, and from those points connect up with the centre points of CF and BD. From M also connect up with F and with P, the latter point being the centre point of BN. Now find the centre point (H) of the line AG, the latter point being that at which occurs the intersection of the diagonals AD and EC. Connect at H with C. One line only remains to be drawn from L to K. This line runs from L toward the point A but is not produced beyond the diagonal EC. The pieces are now ready to be cut out and a start can be made with the game.

At first the efforts to produce a figure will seem hopeless, but jumble the pieces about casually and probably the jumbled arrangement will suddenly seem to bear a remote resemblance to a particular object. Then skill and imagination commence to play their part and in a few seconds a completed figure will lie in front of you—but possibly also you may have a piece or two left over! Now comes the test of ingenuity. *It is the one hard and fast rule that each of the 14 pieces must be used in the completed figure.* It is not necessary that all the pieces should be perfectly in contact one with another, but in considering the final result regard must be had to the effect produced by the gaps. We are quite sure that our readers will enjoy this highly entertaining puzzle. Prizes of Meccano or Hornby trains to the value of £1-1s., 15/–, 10/6 and 5/– are offered to the readers who submit to us the best original examples of Stomachion figures. There will also be a number of consolation prizes.

The entries need not consist of the actual pieces, though these may be pasted on a sheet for submission. Diagrams showing the location of the parts will suffice.

Entries must be addressed to "Stomachion Puzzle, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than 31st December. Overseas closing date, 31st March, 1928.

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Grand Christmas Model-Building Competition

SIXTY VALUABLE PRIZES AND MANY MERIT CERTIFICATES

SAID Mr. Hornby to the Editor of the "*M.M.*"; "During Christmas many boys join the Meccano ranks for the first time, and innumerable others will call in the aid of our old friend Santa Claus to enlarge their existing Outfits by adding Accessory Outfits and parts."

The Editor agreed that this was so.

"Now all these boys will be busy while the holidays last producing all kinds of new models, ideas, and movements," continued the inventor of the World's Greatest Toy," and it behoves us to collect all those ideas and reward the boys appropriately. We must have a Grand Christmas Model-building Competition!"

"Right!" said the Editor, pressing a button on his desk, and to the Office Boy who flung himself in at the door he roared: "Tell every Meccano boy you know that there will be a Grand Christmas Model-building Competition."

"Yessir."

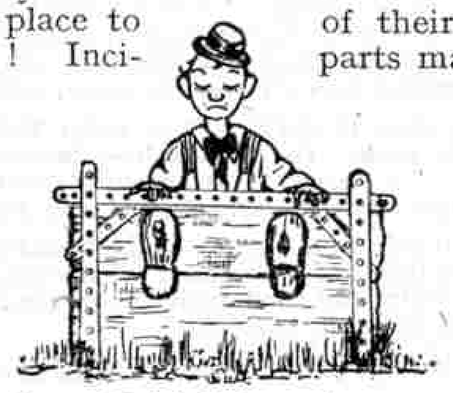
The Office Boy, withdrawing, yelled to the Second Assistant Office Boy for pens, ink, and paper, and these being produced, forthwith sat down and wrote this announcement.

* * * *

It is expected that every Meccano boy will enter this Competition, no matter whether he is young, old, or indefinitely aged, or whether he is of 20 days or 20 years' standing as a Meccano boy. There is sure to be an overwhelming number of entries, but that is all to the good, for prize-winners will feel doubly proud of succeeding in the face of so much competition.

Don't be deterred from entering because you possess only a 00 Outfit. Just think out something new and original, however simple, and construct it neatly. Then photograph your model, or make a neat sketch of it, and send the particulars along to Meccano Limited. After that you may forget all about it for a month or so and one wet, dismal morning when you wake up feeling rather blue you may find a letter awaiting you that will make you decide that the world is not a bad place to live in after all! Incidentally the letter may be the means of transforming your 00 Outfit into a No. 4 or No. 5, with which you can enter more competitions and possibly win many more prizes.

"... Wake up feeling rather blue, to find a letter awaiting you"



"... Models that may be put to some practical use"

The best plan is to send a photograph of your model, of course, but if you cannot manage to obtain a good photograph a clear drawing will do as well. Neither photographs or drawings need be your own work, but the model itself must be the result of your own unaided efforts.

You should send in all necessary explanations concerning your model. These should be written carefully and neatly on one side of the paper only, and they should be as concise as possible. A boy once sent in so many sheets of paper that our Assistant Office Boy had a severe shock, for he thought that the proofs of next month's "*M.M.*" had arrived a fortnight before they were due!

Just a word as to the model itself. Try to be as original as possible in the choice of your subject. Models that really work, or that may be put to some practical use, naturally attract the attention of the judges more than models that refuse to work or fail to reproduce the movements of their prototypes. Any number of parts may be used in the model, but it should be borne in mind that a simple model of straightforward design stands a better chance of coming out at the top of the list than a badly constructed, scrappy-looking model however complicated its mechanism may be. Good, sturdy construction will weigh heavily in the favour of any model.

There are no entry forms to fill in and no fees to pay. The only condition laid down is that the model must be your own unaided work as regards both design and construction. Actual reproductions of existing Meccano models cannot be accepted.

If they are suitable, many of the prize-winning models will be included in forthcoming Instruction Manuals and other Meccano publications that we have in mind, so that your competition model may be rebuilt again and again by Meccano boys of all nationalities. This in itself will be regarded by most Meccano boys as a sufficient reward for the labour involved.

The competition will be divided into four different Sections, as follows:—Section A for competitors residing in the British Isles and over 15 years of age. Section B, for competitors residing in the British Isles and between the ages of 12 and 15 years. Section C, for Competitors residing in the British Isles and under 12 years of age. Section D, for Competitors of all ages residing overseas.

LIST OF PRIZES

The Prizes to be awarded in Sections A, B, and D are as follows:

First Prize; Cheque for three guineas.

Second Prize; Cheque for two guineas.

Third Prize; Cheque for one guinea.

Twelve prizes, each consisting of Meccano products to value 5/–.

A limited number of Certificates of Merit and complimentary copies of "Meccano Standard Mechanisms" Manuals.

The Prizes in Section C are as follows:—

First Prize, Meccano products to value two guineas.

Second Prize, Meccano products to value one guinea.

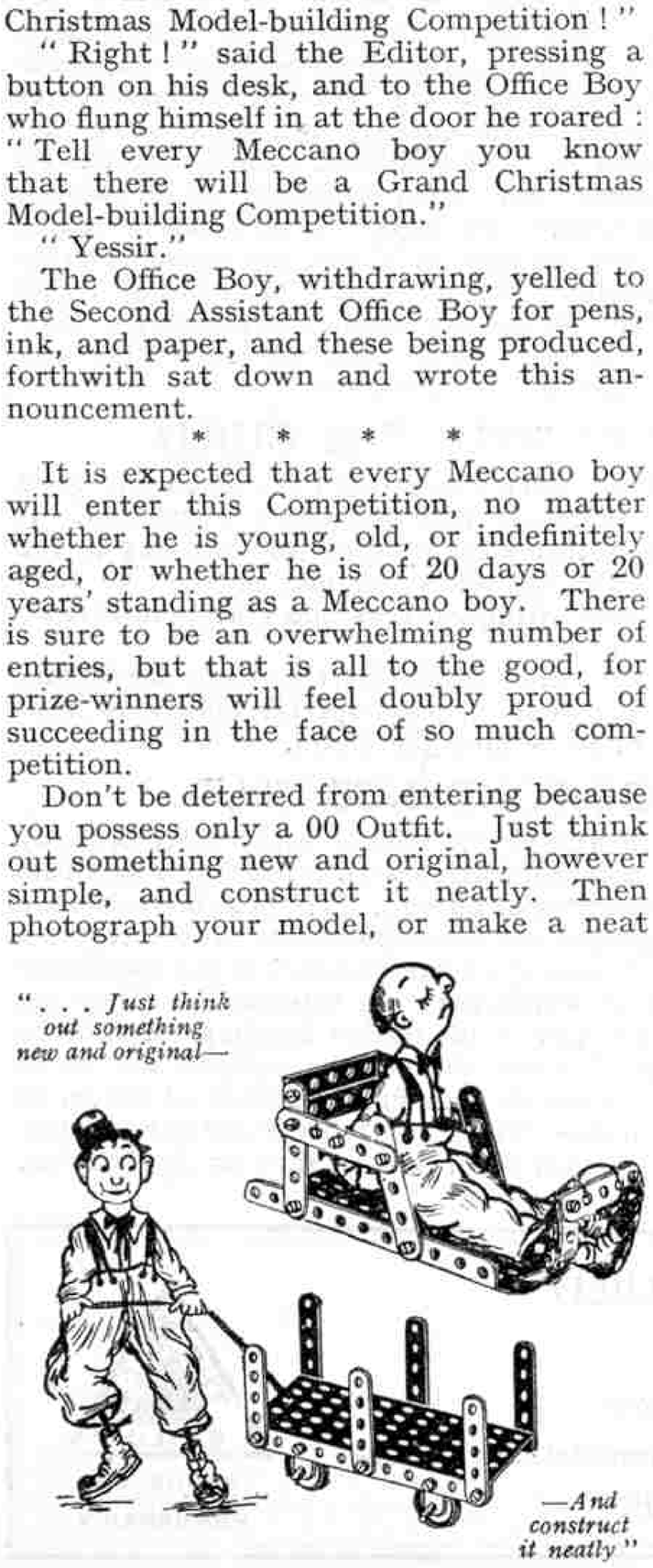
Third prize, Meccano products to value 10/6.

Twelve Prizes, each consisting of Meccano products to value 5/–.

Important Instructions

Your name and address must appear on the back of each photograph or sheet of paper used, together with your age, name of the competition ("Christmas" Model-building Competition) and the Section in which the model is entered. Address the envelope "Christmas Competition," Meccano Ltd., Binns Road, Liverpool.

Entries for Sections A, B, and C must be received by 31st January, 1927. Closing date for Section D: 30th April, 1928.



"... Just think out something new and original—

—And construct it neatly"

"... Good, sturdy construction"

The Meccano Guild

A Great Fellowship of Boys

President: Mr. Frank Hornby ——Inventor of Meccano

What the Guild Means — The Meccano Guild is an organisation for boys, started at the request of boys, and conducted as far as possible by boys. In joining the Guild a Meccano boy becomes a member of a great brotherhood of world-wide extent, every member of which has promised to observe its three great objects; wherever he happens to be—even in strange countries—he will know he has met a friend whenever he sees the little triangular badge. The Meccano Guild is bringing together Meccano boys all over the world, and is helping them to get the very best out of life.

How it Commenced — More than a million boys in Great Britain derive their greatest indoor pleasure from Meccano. Before the Guild was formed, hundreds of these Meccano boys wrote to us every week. They told us how they wished they could be put into communication with other Meccano boys and how they longed to be able to meet them. They asked if arrangements could be made so that their wishes might become an accomplished fact. We responded to their repeated and increasingly numerous appeals, and as a result the Meccano Guild came into being.

Why You Should Join — Every Meccano boy should be a member of the Meccano Guild. All who have studied its objects must agree that the Guild cannot fail to have a profound effect for good on the lives of its members. It is ready to be of service to each individual member—to help or give advice whenever requested. At the head—guiding and controlling, and taking a personal interest in this great movement—is the President, Mr. Frank Hornby, Inventor of Meccano and Managing Director of Meccano Limited.

The Headquarters of the Meccano Guild are at the Head Offices of Meccano Ltd., Binns Road, Liverpool.

THE GUILD RECRUITING CAMPAIGN

Every Meccano boy should become a member of the Guild and do his utmost to help to make the objects of the Guild widely known. With this end in view, a Special Medallion is presented to each member of the Guild who obtains three new recruits. As a mark of further merit the medallion is engraved with the name of the recipient and with the words " Special Award " when six more members are recruited, making nine in all. Full particulars of the Recruiting Campaign, together with a supply of application forms, will be sent on request.

HOW TO BECOME A MEMBER

Membership of the Guild is open to every boy possessing a Meccano Outfit, or Hornby Train Set, who satisfactorily fills in the prescribed application form. The only conditions are that members promise to observe the objects of the Guild and to wear their badges on all possible occasions.

The price of the Guild membership badge is 7d. post free in the United Kingdom, but members abroad will be required to pay 5d. extra for registered postage. A remittance for the necessary amount should be sent along with the form of application. The Guild badge is beautifully enamelled in blue and white and is made for wearing in the lapel of the coat. Any boy wearing the Guild Badge is at once recognised by other Meccano boys as being a member of the Guild and one who has undertaken to live a clean, truthful and upright life.

In addition to the badge, each member receives a membership certificate, measuring 7″ × 9½″. This certificate is printed in orange and sepia and is a smaller edition of the large club certificate.

Write to the Secretary of the Meccano Guild, Binns Road, Liverpool, asking for an application form and full particulars. Then fill in the form and return it to Headquarters, when you will be enrolled and your badge and certificate will be sent to you. Write to-day, and put M.N. after your name for reference.

The Secretary receives hundreds of letters every week from members all over the world and he hopes that new members will also write to him as often as possible.

MECCANO CLUBS

Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters. At the present time there are over 100 affiliated clubs in various towns and villages in this country and abroad, together with a much larger number not yet affiliated. Each club has its Leader, Secretary, Treasurer and other Officials, all of whom, with the exception of the Leader, are boys. If the nearest club to you is too far away for you to join, or if you are unable to join for any other reason, consider the possibility of forming a new club in your own district. A special booklet explaining " How to run a Meccano Club " is now ready, and will be sent to any reader (post free) on receipt of 2d. in stamps.

AFFILIATION WITH THE GUILD

When a Meccano Club has been successfully launched and good progress is being made, affiliation with the Guild is granted. A beautiful club certificate, suitable for framing and hanging in the club-room, is presented, and the club becomes entitled to such privileges as the loan of interesting lectures and club membership cards.

All members of the Guild are eligible for the Merit Medallion, which is awarded to those who display special ability in connection with club work, or in helping the Guild.

THE CORRESPONDENCE CLUB

Members of the Guild are able to join the Correspondence Club, by which they are placed in communication with other Guild members in some other part of the country or abroad. To those boys who are interested in foreign languages the Correspondence Club presents a splendid opportunity of obtaining a correspondent in the particular country in the language of which they are interested. They are able to write to a Meccano boy in his native language, and as he would probably reply in English, the correspondence will be of mutual benefit. Stamp collectors also find the Club of value, as they are enabled to exchange stamps with their correspondents. Full particulars and enrolment form will be sent on application.

BADGE OF MEMBERSHIP

THE THREE GREAT OBJECTS OF THE GUILD

(1) **To make every boy's life brighter and happier.**

(2) **To foster clean-mindedness, truthfulness, ambition, and initiative in boys.**

(3) **To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.**

BADGE OF MEMBERSHIP

With the Secretary

Guild Progress in 1927

The appearance of the Christmas number of the "*M.M.*" provides a useful opportunity of reviewing the activities of the Guild throughout the past year. From every point of view progress has been thoroughly satisfactory. The number of members has increased steadily month by month and there has been greatly increased activity in regard to the formation of new clubs. This activity is fully demonstrated by the list of proposed clubs that appears on this page month by month, and it is very encouraging to note that, while a few of these proposed clubs come to nothing on account of local difficulties, the majority of them become firmly established and before long become affiliated with the Guild.

Some idea of the vitality of the Meccano Club movement may be obtained from the fact that there are now in existence throughout the world over 330 fully-established and flourishing clubs, with steadily increasing memberships.

Increased Efficiency

Even more gratifying than the increase in numbers is the great improvement in the quality of the work carried out by Meccano Clubs. The majority of clubs have greatly extended the scope of their programme and with this extension there has sprung up a new keenness. One reason for this no doubt is that the wider range of subjects has enabled every member to find something of special interest to himself, which is not possible with a programme devoted to two or three subjects only. The introduction of new subjects has also had the effect of attracting the attention of adults who were personally interested in one or other of these subjects and who therefore were easily persuaded to help the club either by lectures or in some other manner.

Successful Exhibitions

The increased enthusiasm and efficiency of clubs has been demonstrated particularly in the numerous exhibitions held either independently or in connection with some local bazaar or other fixture. It is evident that much greater care has been given to the planning of these exhibitions from the point of view of attracting the attention of visitors. Just as a successful shopkeeper takes care that his windows are arranged so as to attract and hold the attention of passers-by, so must a club exhibition be provided with some features that immediately draw attention, and thus lead visitors to examine carefully the more serious items that they otherwise would be liable to miss.

One of the most successful clubs in regard to exhibitions is Holy Trinity (Barnsbury), which has the distinction of being the first club to be affiliated with the Guild. The club recently held its ninth annual two-day exhibition and succeeded in attracting a record number of visitors. Meccano models and Hornby Trains formed, of course, the principal feature, and among the models were a Horizontal Engine, a Traction Engine and a Motor Chassis loaned by Headquarters. Other models included a covered-top type L.G.O.C. Omnibus constructed by the Leader, a Model Workshop, a Swivelling and Luffing Jib Crane, an Aeroplage and a Motor Ambulance. There were also several interesting fretwork and woodwork models made by members of the club and offered for sale.

The special attractions of the exhibition were two in number. The first was a model steam railway kindly lent by the Victoria Model Steamboat Club. This railway was laid up and down the full length of the hall and throughout the two days it provided over 100 visitors with enjoyable rides. The second feature was a "Fine Art Gallery," in which various amusing objects were substituted for pictures. Thus the title "Evening Star" was attached to a copy of an evening newspaper, while "The Schoolmaster's Assistant" was—a cane! Best of all perhaps was an exhibit with the pathetic title "Last Words"—the said words being "Get Out!" This feature caused an enormous amount of amusement and undoubtedly was a great attraction.

Special Merit Medallions Awarded in 1927

ANNAN—O. Gibbs, H. Shaw. BARROW-IN-FURNESS—K. R. Sladen, N. Thompson. BECCLES—B. Andrews, H. Self. BIRKENHEAD—R. Aviss. BIRMINGHAM (King Edward VI School)—A. L. Noke. BLACKBURN (Holy Trinity)—F. Collum, F. Hulme, H. Snooks. BLANTYRE (Stonefield Parish Church)—W. Calder. CASTLE DOUGLAS—G. Armour, P. Thomson. CREDITON (Queen Elizabeth's School)—A. Sprague. EXETER—H. V. Brading, H. Darville, H. Holman, W. Pitt, W. D. Richardson. EXETER (Whipton)—S. Dare, N. Martin. GREAT BADDOW—G. Hawes, G. Herd, L. Rust, H. Steel, W. Walden, F. Watts. HARWICH—A. Durrant, A. Stephens. HIGH WYCOMBE (Royal Grammar School)—H. R. Foden, J. W. Chapman. LEEDS (West Leeds)—S. Blackburn, R. Eccles. LETCHWORTH (Westbury)—E. Moye. LEICESTER (Winchester Avenue)—E. Ingles, L. Warburton. LONDON:—S.E.20 (Ashburton School)—R. Dunscombe, J. Firminger. BARNSBURY (Holy Trinity)—W. Endres, J. How, G. Rowley, F. Trobridge. NEWINGTON (St. Mary)—L. Brockett, R. Gudgeon, W. Need, W. Nixon. WINCHMORE HILL—D. Irvine. MIDDLESBROUGH—J. Allick, T. Simpkins, N. Williams. NORWICH (St. Peter, Mancroft)—C. Ford, L. Oates, C. A. D. Oxbury, J. Vyse. ROTHERHAM—L. Nicholson, A. E. Wood. ST. ALBANS—A. H. Dunkley, B. H. Harden. TENTERDEN—C. Clare, J. Dapson, J. H. Manktelow, R. Sharpe. TONBRIDGE—C. Copper, W. Sawyer.

OVERSEAS CLUB MEMBERS

AFRICA (Clifton)—E. Baggaley, M. Erasmus, A. Francis, H. Genders, B. Moussouris, B. A. O'Donovan. JOHANNESBURG (Malvern)—T. Trent. CAPE TOWN (Observatory)—G. Boyle, T. Aberdein. INDIA:—DELHI—T. L. Malkani. MADRAS (Excelsior)—S. A. Royan, S. P. Senji. ITALY:—SIENA—D. P. Mario, C. Sandro.

MEMBERS NOT ATTACHED TO CLUBS

FEDERATED MALAY STATES:—KUALA LUMPUR—D. G. Abeyeratne.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters whose names and addresses are given below:—

ACCRINGTON—Fred Britcliffe, 7, Trinity Street, Oswaldtwistle, Accrington.
AIRDRIE—G. Burns, Groveside, Quarry, Airdrie.
ASHINGTON—D. C. Absalom, "Dene-Holme," Wansbeck Terrace, Ashington.
BELFAST—Denis Killen, Cabin Hill, Knock, Belfast.
BINGLEY—Harold Cook, 18, Amy Street, Bingley, Yorks.
BOLTON—N. Settle, 24, Priory Place, Tonge Moor, Bolton.
BROADSTAIRS—W. R. Sharp, Springcroft, Osborne Road, Broadstairs, Kent.
HEREFORD—David Barns, Eign Street, Hereford.
HULL—R. Ward, 8, Brougham Street, Albert Avenue, Hull.

CLUB NOTES

Merelands (Hull) M.C.—In a ramble held recently a party of club members travelled by bus from Hull to Hessle and walked along the Humber Bank to Ferriby where a halt was made for tea and games. Later a bus was taken from Ferriby to Hull and the members voted that the afternoon was most enjoyable. A Mystery Trip provided another interesting field day. Under the direction of Mr. Steel, the Leader, members crossed the Humber and boarded a train for an unknown destination. This proved to be Thornton Abbey, where a most enjoyable afternoon was spent in exploring the ruins. Fortnightly meetings are held during the winter session. Club roll: 11. *Secretary*: P. Gambie, 53, Albany Street, Hull.

Eastham M.C.—The success of the Girls' Section is a striking feature of the work of the club. A No. 3 Outfit has been purchased for the benefit of this section and the members are proving themselves as capable as those of the opposite sex. In several recent Model-building competitions the girls have actually proved superior. Another interesting feature is that any idea that occurs to a member is discussed at the next Committee meeting if mentioned to a member of the Committee. In this manner the officials keep in close touch with the wishes of the individual members. A silver paper collection for the hospitals has been started. Club roll: 32. *Secretary*: Fred Taylor, School Lane, Eastham, Nr. Birkenhead.

Albert Village M.C.—A strong and enthusiastic football team has been formed and several excellent matches have been played. A Running Section has now been organised. The programme for the immediate future includes a Concert arranged to celebrate the completion of six months existence as an affiliated club. The members are now turning their attention to trains, a proposal to form a Hornby Section having been made. Club roll: 21. *Secretary*: L. C. Adey, 239, Occupation Road, Woodville, Burton-on-Trent.

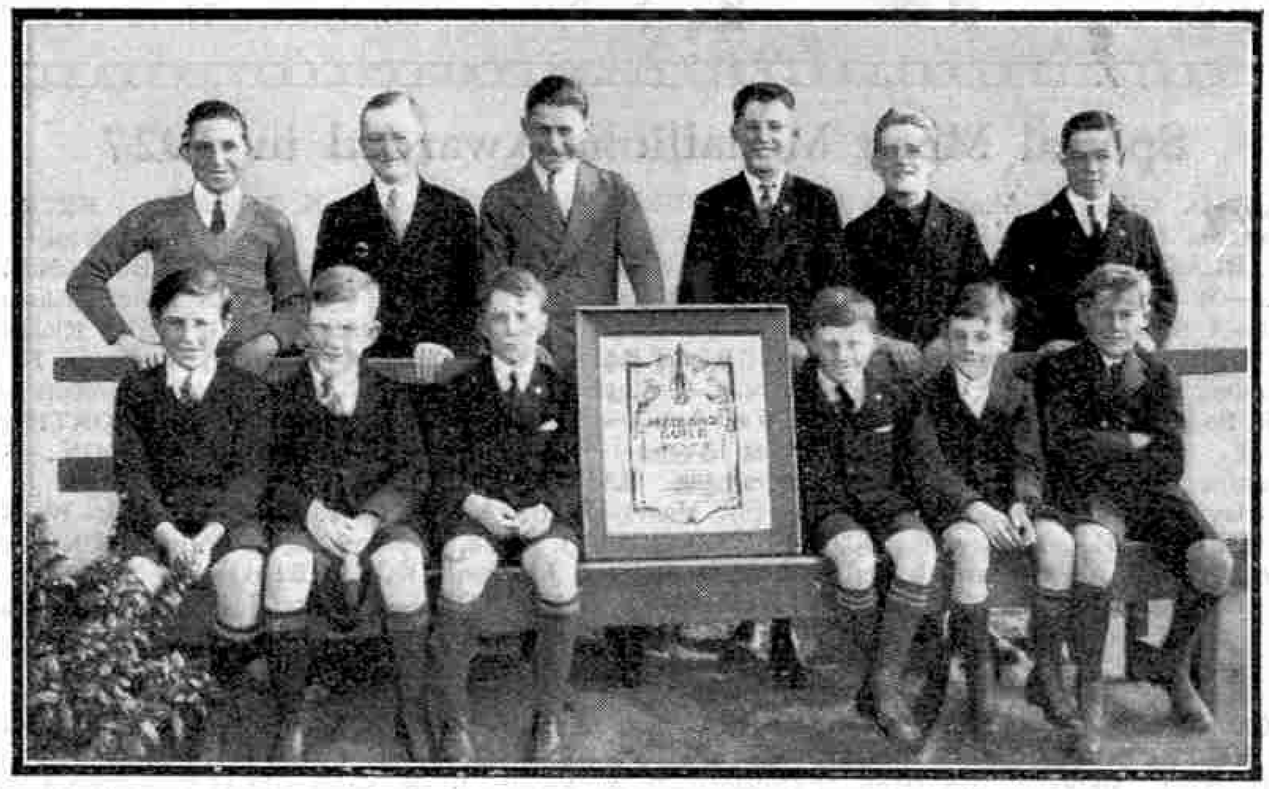
St. Albans M.C.—New members are still being enrolled and the boys are making every effort to recruit more members. A Mock Trial figures among the coming attractions and the members are looking forward to it with eagerness. The fine Library now possessed by the club is very popular with the members. Club roll: 20. *Secretary*: H. M. Upward, 19a, Worley Road, St. Albans.

Westbury M.C.—A Library is to be formed in the near future and a Stamp Section is under consideration. The programme arranged for the present session includes interesting Lantern Lectures and several Competitions. An interesting innovation is that no prizes are to be awarded in the separate competitions. Instead marks are to be given and at the end of each set of four Competitions a prize will be awarded to the boy having the highest number of marks. Club roll: 24. *Secretary*: Eric Moye, 24, Burnell Rise, Letchworth, Herts.

Pendleton M.C.—This club has had a series of misfortunes which have prevented it making a good start but an excellent recovery has been made. A most interesting programme has been drawn up and outdoor attractions have not been forgotten, football being specially popular among the members. Club roll: 27. *Secretary*: Edward Gibson, 20, Grosvenor Place, Cross Lane, Salford.

Stationers' School M.C.—An interesting syllabus has been drawn up for the winter session, including Model-building, Hornby Nights and Games Evenings. Meetings are held regularly on Monday evenings and several football matches have been arranged. A visit paid to the "Star" Newspaper Works proved very instructive and was very much enjoyed. The club has an excellent Magazine that is flourishing and growing in popularity under the new Editors. Club roll: 25. *Secretary*: E. S. E. Gardner, 27, Priory Road, Hornsey, London, N.8.

Hampton (Australia) M.C.



Our photograph shows a group of members of the Hampton (Australia) Meccano Club. This club came into being in September 1926 and the untiring enthusiasm of Leader and Secretary has brought it to its present excellent standard. A successful Exhibition was held in June of this year and another has been proposed for early in the new year. The club has been divided into two sections, and the members are very keen on model-building competitions

Belgravia M.C.—This club is very popular in the district and meetings are well attended. The most popular feature is Model-building, and the Leader has given several prizes for the best models built. In a competition held recently each member was requested to bring a number of parts and the club was then divided into sections. The section that made the greatest number of models in an hour was awarded the prize. Mr. Cabeldu, the Leader, very kindly allows the club to use a part of his shop window in which to exhibit models in order to advertise the club. An Exhibition has been arranged and it is hoped will be a great success. The club unfortunately is without a proper club-room and help in this direction will be greatly appreciated. New members will be made very welcome and should apply to the Secretary for full particulars. Club roll: 46. *Secretary*: R. Woolidge, 29, Rosenthal Road, Catford, S.E.6.

Sparkhill M.C.—The Secretary of this club has been obliged to resign and the late Secretary has taken over the position. A new club-room has been secured and an enjoyable session is anticipated. It is hoped that several Lantern Lectures will be given during the session. The club is flourishing and has a good attendance. The Annual Outing proved a great success and the boys had an enjoyable time. Club roll: 24. *Secretary*: E. Stewart, 44, Benton Road, Sparkhill, Birmingham.

Northwood M.C.—The club re-opened after a long vacation but unfortunately the Leader has been unable to attend several meetings. The bad weather has prevented some of the boys from attending regularly so many of the meetings have been devoted to games. F. C. Brown has resigned the secretaryship. It is hoped to hold a display early in the new year and a local patron, Pastor Grosvenor, has promised his assistance. Club roll: 18. *Secretary*: A. S. Whiddington, Pencarrow, Sandy Lodge Way, Northwood, Middlesex.

Memorial (Hull) M.C.—An Exhibition has been arranged to take place in January. Under the guidance of the Leader, the members are all making strenuous efforts to ensure success. The programme is varied and includes many interesting subjects, Games Nights, Competitions, and Exhibitions of working models figuring prominently. Meetings are held fortnightly during the winter months and those wishing to join should communicate with the secretary. Club roll: 12. *Secretary*: Philip Jackson, 68, Westbourne Avenue, Hull.

Birkenhead School M.C.—This club has started the Winter Session well. It has been divided into three sections, namely the Railway, Airship and Aeroplane, and models and Engineering sections respectively. A special Model-building competition is to be held on the 14th of this month. Mrs. Quaile, the treasurer's Mother, is very kindly presenting a No. 3 Meccano outfit as first prize. The club has removed from its quarters in Birkenhead School to a new club-room in the basement of a house in the immediate vicinity. Average attendance: 19. *Secretary*: C. G. Jones, Roxbury, Waterpark Road, Prenton, Birkenhead.

Hastings Central M.C.—The club continues to make good progress. A 220-volt electric motor has been installed permanently for the use of the club members and many excellent models were built for the Exhibition held recently. A concert has been arranged. Club roll: 31. *Secretary*: W. V. Veness, 9, Earl Street, Hastings.

Victoria (Glasgow) M.C.—A visit that is exciting much interest is to be paid to the liner "*Cameronia*." The syllabus includes many interesting features, including Model-building, Lectures, Games Nights, Socials, Papers by members and many other items. The club has been divided into five sections, namely, Nuts, Bolts, Washers, Clips and Hooks. Various tournaments are being arranged for the different sections and prizes will be awarded. The Model-building nights are being arranged in a very novel way, as models are to be built of things seen in the road, at the docks, or on the railway, etc. Although the club membership is not so large as last year the members seem to be more enthusiastic. They are now collecting as many queries regarding motor cars as possible as one of them is a motor mechanic and can tell them anything they wish to know. Club roll: 28. *Secretary*: Henry C. Thompson, 4, Montgomerie Gardens, Scotstoun, Glasgow.

St. Mary (Newington) M.C.—The club re-opened in September for the Winter Session when the Club President and the Leader addressed the members and the programme for the session was discussed. The Leader recently gave an interesting lecture on "The History of Railway Signalling" illustrating it with Meccano models, Hornby Trains, and the club's Model Railway. A Sale of Work has been arranged and the boys are working hard for it. Meetings are well attended and a good membership is maintained. Club roll: 121. *Secretary*: Mr. C. Curle, 37, Pullens Estate, Peacock Street, London, S.E.17.

Hessle M.C.—Model-building takes a prominent part in the club syllabus and lectures are given on the models built by the members. The club possesses an excellent Library and evenings are devoted to the exchange of books. Football is popular and several good matches have been played. The oldest club member was recently elected vice-leader. The secretary will be pleased to hear from any intending new members. Club roll: 22. *Secretary*: T. A. Fillingham, "Red Lea," Marlbro Avenue, Hessle.

Holbeach Wesleyan M.C.—The club is in a much better position than before and the Winter Session is proving highly successful. The programme includes Lantern Lectures, Model-building, Book Evenings and other interesting features. A recent model-building evening was devoted to the building of models suitable for warfare. Many interesting models, such as searchlights, tanks, guns, ambulances and tractors were built and the members showed great ingenuity. The members are all very keen and the secretary is anxious to increase the club roll. Two savings departments have been started, one to purchase new Meccano parts, and the other to provide funds for the Outings Club. Club roll: 16. *Secretary*: Walter Cook, Hallgate, Holbeach, Lincs.

Clubs Not Yet Affiliated

Sheffield M.C.—A suitable club-room has been secured at the Fulwood Vicarage Parish Room and meetings are held on Saturday evenings at 7 o'clock. Intending members can obtain full particulars from K. A. Stewart, 150, Tom Lane, Sandygate, Sheffield.

Brixton Hill M.C.—Is making excellent progress and the club roll is growing steadily. Unfortunately a suitable room cannot be secured and the meetings are at present held in the home of the Secretary. When the membership increases this arrangement will become impracticable and it is hoped, therefore, that a suitable room will be secured in the near future. Anyone who is willing to loan or rent a room to the club should communicate with the *Secretary*: J. Morton, 17, Ostade Road, Brixton Hill, S.W.2.

Uttoxeter M.C.—The Winter Session commenced in grand style and Mr. Mellor has again accepted the Leadership. The old club-room has been secured and meetings are to be held weekly. An interesting programme has been arranged including several lantern lectures to be delivered by the Leader. Preparations are being made for an exhibition that is to be held in the near future. New members will be given a hearty welcome. *Secretary*: E. H. Davies, 4, Heathfield Road, Uttoxeter.

Lichfield Central School M.C.—This club is now firmly established and excellent progress is reported. A secretary has been appointed and meetings are well attended. *Secretary*: Thomas Marshall, 30, Chesterfield Terrace, Lichfield, Staffs.

Knock (Co. Down) M.C.—A number of boys have already been enrolled as members of this club, but difficulty is being experienced in regard to the securing of an adult Leader. Any gentleman in the district who is willing to help the boys should communicate with the secretary, who will be very grateful for any assistance. The members are all very keen and those wishing to join should write for full particulars to J. T. Taylor, Dunsinnan, Sandown Road, Knock, Co. Down.

Hampton Court M.C.—The secretary reports that satisfactory progress is being made. A display of fireworks was organised in order to raise funds and quite a number of tickets were sold. The club is still open for more members and the secretary will be pleased to give full details. *Secretary*: Cyril G. R. Lewis, Clegg's Hotel, Hampton Court, Middlesex.

Sale Moor M.C.—A talk was recently given by a local gentleman on the subject of Astronomy, and it was very much enjoyed and appreciated by all present. Various interesting items have been arranged for the future and intending members should give in their names as soon as possible. Leader: Mr. A. I. Rogers, 65, Marsland Road, Sale Moor, Manchester.

Grosvenor Square (London, W.1) M.C.—The club is making excellent progress and already a Leader and club-room have been secured. Meetings are held every Thursday at the home of the secretary, from 6 to 8.30 p.m. New members will be given a cordial welcome. Already the club roll numbers 17 and enjoyable evenings are spent in Model-building. The club possesses a good Library comprising about sixty books and Magazines. *Secretary*: Roland H. Pike, 11, George Yard, Grosvenor Square, London, W.1.

Bristol M.C.—A club has been formed at the Grammar School. A recent meeting was devoted to the construction and use of a track for Hornby Trains. The Leader intends sending his application for affiliation when several more meetings have been held. An interesting programme is being drawn up and promises to be very attractive. Leader: Mr. H. Dunindoff, The Grammar School, Bristol.

Hull M.C.—This club is making good progress and a club room has been secured. Meetings are held every Friday but unfortunately a suitable Leader has not yet been secured. The Secretary would be very pleased if any gentleman in the district who is willing to offer his services would communicate with him. *Secretary*: R. Ward, 8, Brougham Street, Albert Avenue, Hull.

Heston Church M.C.—A Leader has now been secured and with his assistance it is hoped that good progress will be made. The club roll already shows a decided increase and all the members are joining the Guild. *Secretary*: G. Craggs, "The Limes," Lime Tree Road, Lampton, Middlesex.

Buckhurst Hill M.C.—Is making excellent progress and the Leader has already applied for affiliation. An interesting syllabus has been arranged including Model-building, Lectures on many interesting subjects, Competitions and Stamp Evenings. The club roll is slowly increasing. *Secretary*: D. Mason, "Lyndale," Palmerston Road, Buckhurst Hill, Essex.

Worthing M.C.—The Winter session has been started successfully. New members are urgently required and will be given a hearty welcome. *Secretary*: R. Knowles, "Shanklin," 69, St. Thomas' Road, Worthing.

Up the pole! An episode at the summer camp of the Weston M.C.

Darlington M.C.—Efforts are being made to re-establish this club for the winter and it is hoped to commence with a social evening or concert. There are prospects of obtaining a Leader before long. Meccano boys wishing to join should communicate with the *Secretary*: A. L. Pankhurst, "Beech House," West Auckland Road, Darlington.

Arrantrue (Renfrew) M.C.—A suitable club room has been secured but the Secretary has not yet been successful in securing a suitable Leader. Meetings are held every Saturday morning at 10 o'clock and a very interesting programme has been drawn up. A Library has been started and a number of books have already been collected. A Librarian has been appointed and is doing his best to make it a success. New members will be heartily welcomed and the secretary will gladly furnish full particulars. *Secretary*: R. Turner, Wemyss View, St. Andrews Road, Renfrew, Scotland.

Horsforth M.C.—A club has been formed in the district and several meetings have already been held. Model-building is popular and a Competition was organised recently for various types of Cranes. An exhibition is being held and is to be followed by an entertainment. Unfortunately a Leader has not yet been secured and it is hoped that a suitable gentleman will soon adopt the position. An interesting syllabus has been drawn up and the members are all enthusiastic. *Secretary*: J. K. Sutcliffe, Atlas House, Horsforth, Nr. Leeds.

Hurlestone M.C.—A proposal to change the name of the Dulwich Hill M.C. to Hurlestone M.C. was agreed to by vote. New members are required and will always be welcome. *Secretary*: T. Watson, 7, Abergeldie Street, Dulwich Hill, N.S.W., Australia.

Rothesay M.C.—Mr. Maitland has very kindly consented to adopt the Leadership and it is hoped shortly to apply for affiliation. Arrangements are being made for a visit to the local Tramway Station and Gas Works. *Secretary*: J. Alston, "Avondale," 17, Ardbeg Road, Rothesay, Bute.

Kempston M.C.—Good progress is reported and the Winter Session is proving a success. It is hoped to include a social at an early date. An excellent club-room has been secured free of charge and the members are grateful for this. Competitions are being arranged and the members are all very keen. *Secretary*: Roy Clarke, 50a, High Street, Kempston, Beds.

Hove M.C.—Good progress is reported and a Leader has been secured who takes a keen interest in all activities. A small magazine has been started and promises to be a success. New members will always be welcome and should communicate with the Secretary. *Secretary*: R. Webb, 7, Glendale Road, Hove.

St. Christopher School (Letchworth) M.C.—A club has been started at the school and is now firmly established. The membership shows a rapid increase and the boys are all very enthusiastic. Already a club room has been secured and visits to large factories in the town are contemplated. A Junior section is to be formed and probably the membership will be increased by about thirty. The Secretary is hoping that affiliation will shortly be effected. *Secretary*: C. B. Dolton, Arundale House, Letchworth, Herts.

Swindon M.C.—The Secretary of this club is anxious to enrol new members and any boy who is interested in the club should communicate with the Secretary who will be pleased to give all particulars. The club roll is now twelve and it is hoped that affiliation will be granted in the near future. A Social Evening is to be held at Christmas and this will probably be followed by a Concert. *Secretary*: A. Chappell, 146, Ferndale Road, Swindon, Wilts.

Fishponds and Staple Hill M.C.—The father of the club secretary has very kindly consented to adopt the Leadership of the club and it is now hoped that affiliation will be effected in the near future. A number of rules have been drawn up and a copy has been printed. Several of the members paid a visit to Fry's chocolate factory and this was greatly enjoyed. *Secretary*: Eric R. Pritchard, 17, Brentry Road, Fishponds, Bristol.

Overseas Affiliated Clubs

South Africa

Clifton M.C.—A new feature is a Vigilance Committee, whose duty it is to deal with any lax members and to visit any sick members. An interesting Lecture recently given by the Rev. C. Kellick on "*The Club and its Aims*" was very much enjoyed. A contest was held for the best design for the club notepaper and this proved quite a success. The club paid a visit to the Malvern M.C. on the occasion of their Fancy Dress Party and this evening proved highly successful. Model-building is popular and contests are arranged every month. The membership is rapidly increasing but new members are always welcome. Club roll: 36. *Secretary*: Hermann Jacobsen, 169, Loveday Street, Clifton, Johannesburg, Transvaal, South Africa.

Australia

Glebe (Tasmania) M.C.—Weekly meetings are held in the club-room. A recent Contractors' night proved highly successful. The Sydney Harbour Bridge was the subject chosen, and a short talk was given, from the "*Meccano Magazine*," on the building of this bridge. Table Tennis is quite a prominent feature of the syllabus and contests are keenly enjoyed. A recent speed building contest was keenly contested and it is hoped to organise other competitions. Games evenings are popular, and a "Meccano Magazine" evening proved highly successful. Various articles were read from the Magazine and discussed. New members will always be welcome and full particulars may be obtained from the *Secretary*: Miss M. M. Sculthorpe, 5, Short Street, Glebe, Hobart, Tasmania.

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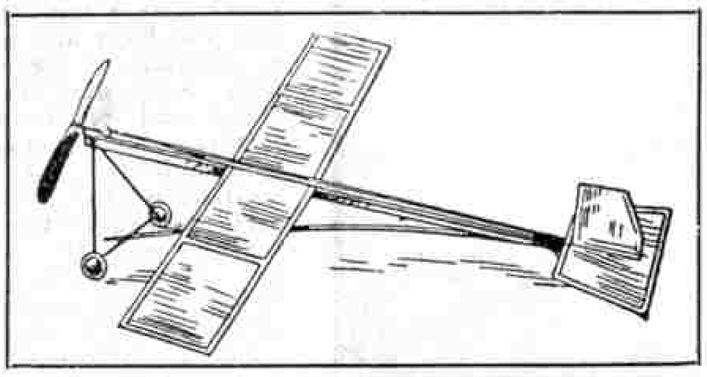

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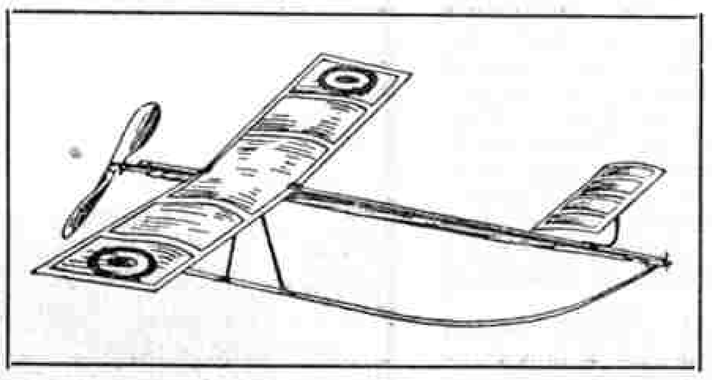

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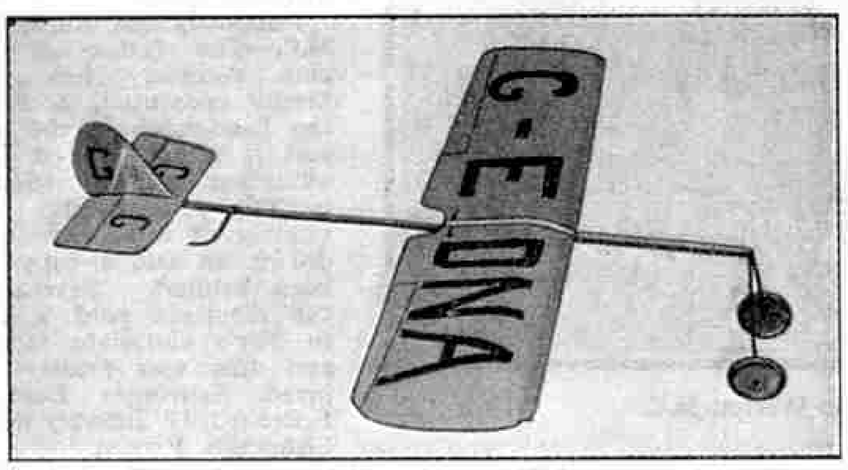

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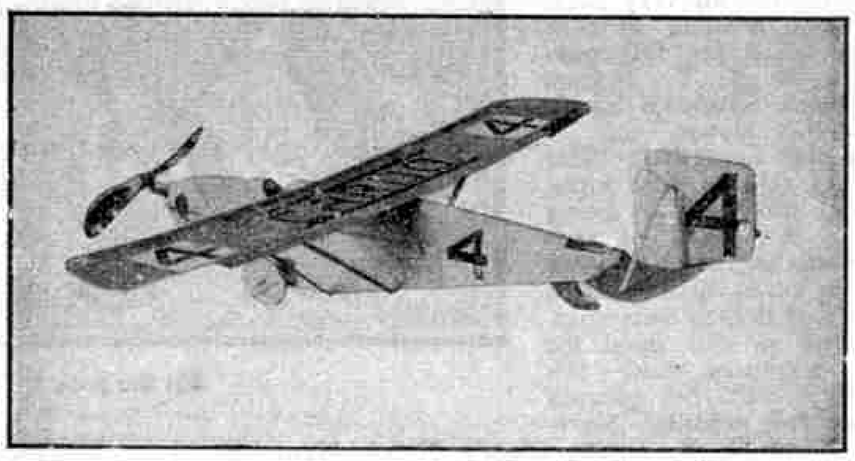

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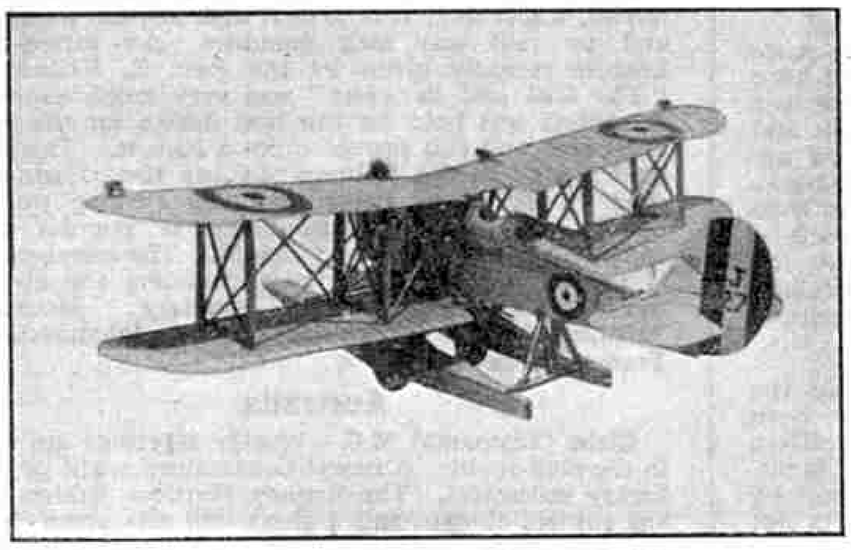

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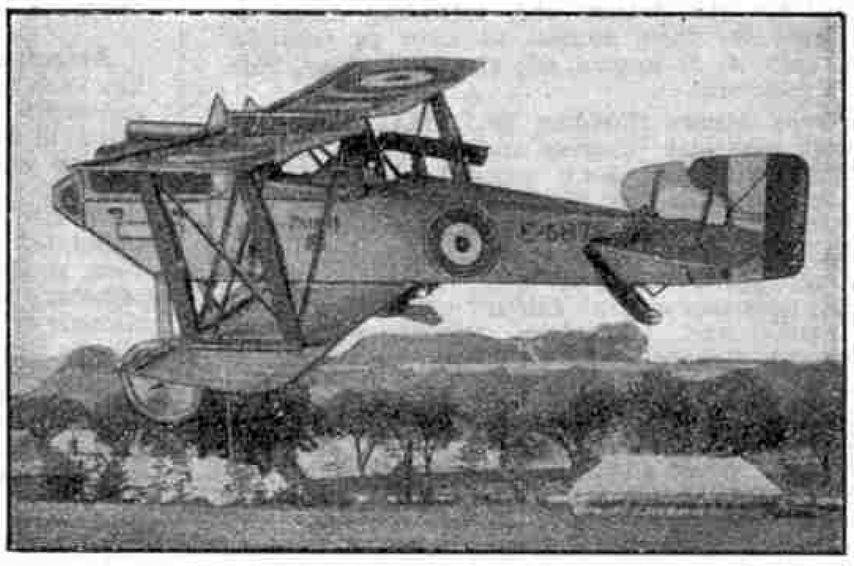

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Famous Trains—(*continued from page* 1059)

at the inclination mentioned, more particularly between Gretna and Lockerbie. But this is nothing to the "Bank" itself, which rises from Beattock for 10 miles continuously at between 1 in 88 and 1 in 69. For the 39¾ miles from Carlisle to Beattock 48 minutes are allowed, but the ensuing 10 miles require 21 minutes and it is quite possible that a minute or two gained between Lockerbie and Beattock may be added to the climbing time.

In the next 2¼ miles the railway drops at 1 in 99 into the valley of the Clyde, and remains in it, more or less, all the way to Glasgow. Actually the river is crossed six times—at Elvanfoot, Crawford, Lamington, near Carstairs, Uddingston and then just as the railway enters the Central Station at Glasgow.

After Elvanfoot the fall is gradual for 10½ miles to Lamington, and then there are undulations for 15 miles past Symington and Carstairs to Craigenhill Summit, whence there is a steep and continuous fall for 15½ miles at between 1 in 99 and 1 in 135, to Uddingston. High speeds are seldom attained on these falling grades, going north, as the descent from Beattock Summit to Lamington winds considerably, and down from Craigenhill coalmining country is traversed, which means moderated speed on account of subsidences. So speeds much in excess of 60 m.p.h. are unlikely, and cautious travelling is amply allowed for in the schedule of the train.

Twice between Carlisle and Glasgow it is possible to take water from track-troughs, which a couple of years ago were laid for the first time in Scotland near Floriston, about seven miles from Carlisle, and just south of Carstairs, in preparation for the long West Coast runs since instituted. Eleven sets of track-troughs in all are therefore available over the 401½-miles' journey between Euston and Glasgow.

Mention has been made previously of our departure from Carlisle at 3.50 p.m.; 4.38 p.m. should see us through Beattock and 4.59 p.m. breasting Beattock Summit, at a speed of between 20 and 25 or 30 miles an hour. At 5.17 p.m., having covered with ease the 17¼ downhill miles from Summit in 18 minutes, we are drawing up at Symington, under the shadow of the bold Lowland summit known as Tinto Hill. Passengers are not allowed to leave or join the train either here or at Carlisle—the "*Royal Scot*" is, indeed, a strictly "limited" express, conveying passengers for Glasgow and Edinburgh only—but the stop is for the purpose of detaching the Edinburgh portion, for which we shall see waiting, in all probability, a Caledonian 4–4–0 engine.

At 5.20 p.m. we are away again, and as 50 minutes proves all too ample an allowance for the 35½ miles from Symington down to Glasgow, the chances are that, given a clear road, we shall finish our journey before time. Last time I travelled on the train we rolled into Central Station at 6.3 p.m., no less than 12 minutes early by the public arrival time of 6.15 p.m. In the working timetables the scheduled time of arrival is 6.10 p.m.; but so easy is the task of haulage to the new "Royal Scot" engines that a booking of 7¾ hours from London or even less, would cause them little concern. Let us hope that, ere long, it will be possible to travel from London to the chief Scottish cities at a throughout average speed of 50 miles an hour and that the "*Royal Scot*" will be one of the trains to do it!

Choose your own Christmas Present!

It is a wonderful sensation to sit down and study illustrations and descriptions, and select your own Christmas present. Try it!

In our pages this month there are advertisers' announcements of all kinds of splendid toys, books, and all manner of articles for giving pleasure to boys at Christmas. We are going to make at least one boy happy by giving him the very thing he wants from amongst the articles advertised in our columns.

Look carefully at *all* the advertisements and decide which article you would like the postman to hand to you on Christmas morning. Write the name of it on the top of your postcard, marking it No. 1. Then write the name of the article that you would like second best and mark it No. 2. Do this with six articles altogether, write your own name and address at the bottom in very plain letters, and send the postcard to "Christmas Presents, *Meccano Magazine*, Binns Road, Liverpool."

To the sender of the list that corresponds most nearly in order of merit with the total voting we will post the article that heads his list, to reach him on Christmas morning.

"Christmas Presents" postcards must reach us not later than 17th December.

Landing Ocean Mails—(*cont. from page* 1034)

designed so that the resulting force passes normally through the base of the tower, thus rendering extensive foundations unnecessary. When not required for use, the conveyor can be raised by the winch, swung clear of the dock by hand, and lowered into any desired position.

While the number of mail bag and parcel-post packages landed at Plymouth from ocean liners already amounts to many thousands monthly, the installation and successful working of this conveyor must tend to increase still further the popularity of Plymouth as a port of call.

Model Building Contests—(*cont. from page* 1075)

a reversing lever, steering gear, and brakes on the rear wheels. The elevation and extension of the escape are controlled by hand wheels and regulated by pawl and ratchet mechanisms.

Robert Whittingham's entry is in the form of a Meccano Orrery. Although simply constructed and using few parts, this forms a most interesting model. The rotation of the Earth and its satellite, the Moon, are reproduced, as well as the progress of both bodies round the Sun. The latter, by the way, is represented by a candle, the light from which serves to illustrate the phenomena of day and night on the Earth.

Readers will observe from the illustration that the First Prize-winning model in Section C represents a tramcar of the type used in Manchester. The method of attaching the trolley arm to the roof of the car is open to criticism, but taken on the whole, I regard this model as an excellent piece of work.

James Yates' entry is in the form of a single-deck motor 'bus. It is fitted with lamps, leaf springs, a door giving admission to the driver's seat, and another at the rear of the coach. The road wheels consist of 3" Pulleys fitted with Dunlop Tyres.

John Warren Davis, the Third Prize-winner in this section, submitted two models. One is a neat model biplane and the other is a pleasing representation of a suspension bridge.

Electricity and Meccano—(*cont. from page* 1083)

know already that when a current is sent through a coil of wire the coil becomes a magnet, having a north pole and a south pole. In the present case the coil in our dynamo becomes a magnet immediately the current from the second dynamo is switched on, and the attraction between its poles and the opposite poles of the magnet causes it to make half a revolution. At this stage the commutator reverses the current, and consequently also the polarity of the coil. There is now repulsion where before there was attraction, and the coil makes another half revolution. This process continues until the armature attains a very high speed. The operation of an electric motor is thus based on the attraction between unlike poles and the repulsion between similar poles.

Having dealt briefly with the more important principles of electricity, we shall proceed next month to describe the construction and use of some simple but essential pieces of electrical mechanism.

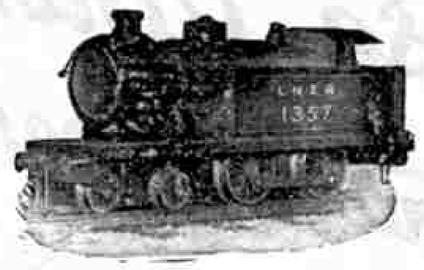
Toys for Christmas

Hamley's Branches are now showing a fine selection of toys and games and an interesting afternoon may be spent examining them. A good way to choose what you would like for Christmas is to take a pencil and notebook and make a list of the things you like best, then the choice can be narrowed down later.

Hamley's, by the way, have prepared a fine catalogue and if you send them your name and address, they will send a copy free of charge. This is a great help if you live too far away to visit their Showrooms. The catalogue is packed from cover to cover with hundreds of illustrations and you should be sure to mention the "*M.M.*" when asking for your free copy.

British Made Locomotives

31 E. Reversing Tank Electric Locomotive. With powerful 4-volt motor, cast flanged wheels with coupling rods, etc. Length 8½ ins. Can be had in L.M.S. or L.N.E.R. colours. Gauge 0–1½ ins. Fully guaranteed. Price **25/–** Post Free.



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25 S. 0 Gauge Steam Loco. Brass boiler, brass oscillating cylinders, anti-friction pistons, automatic oiler, wind guards. Will steam about 15 minutes with one filling. L.M.S. or L.N.E.R. Colours. Price **12/6.** Postage **6d.**

30 S. Strong Heavy Steam Loco. 0 Gauge, brass boiler, brass oscillating cylinders, anti-friction pistons, automatic oiler, wind guards. Will run for half-mile with one filling. Exhaust through the funnel. Price **21/–.** Postage **6d.**

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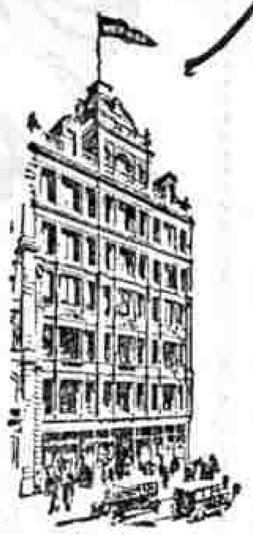

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All you have to do is to send your own name and address and the name and address of your chum, together with a remittance of 4/– for six issues or 8/– for twelve issues, to the Editor, "*Meccano Magazine*," Binns Road, Liverpool. He will arrange for the Magazines to be sent in good time to reach your chum on the morning of publishing day, the 1st of each month.

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Fireside Fun

FLATTERY

It was cleaning day at the Zoo. All the animals had to be shifted from the cages they usually occupied into fresh ones, and an Irishman was assisting with the transfer of the hyena.

"Stiddy there, lion!" he quavered.

"What's the idea of callin' that hyena a lion?" asked a fellow attendant.

"Have ye no tact? Can't ye see 'tis flattering the baste that I am?"

* * * *

Two commercial travellers were waiting for the same train, when one turned to the other.

"That's a strange label you've got pasted on your bag" he said.

"Ah," returned the other, "it's a new idea! Here's a similar one. I had a lot printed before I left home. Read it."

The questioner took the slip of paper and read it aloud:

"'While a trunk was being handled carelessly at a railway station recently, it exploded and seriously injured the porter." He finished and looked up.

"Have a few?" asked the other man, putting his hand in his pocket. "You'll find them very useful!"

* * * *

The auctioneer held up a battered fiddle.

"Lot twenty-four," he announced to his audience, who were for the most part neighbouring farmers. "Now, what am I offered for this beautiful violin?"

"Take a look at its case. See the blurred finger-marks of remorseless time. To the merry notes of this fine old instrument the brocaded dames of fair France may have danced the stately minuet in the glittering ball-rooms of Versailles. Now, gentlemen, what do you offer me for this instrument?"

"Half-a-crown," said one.

"It's yours," declared the auctioneer cheerfully. "Now for lot twenty-five!"

* * * *

"HAIRSY TOATS!"

"Hairsy toats, mairsy toats and little lamsitivy!" hissed George, very quickly.

Geraldine jumped. "My goodness!" she said. "What's that? A secret language?"

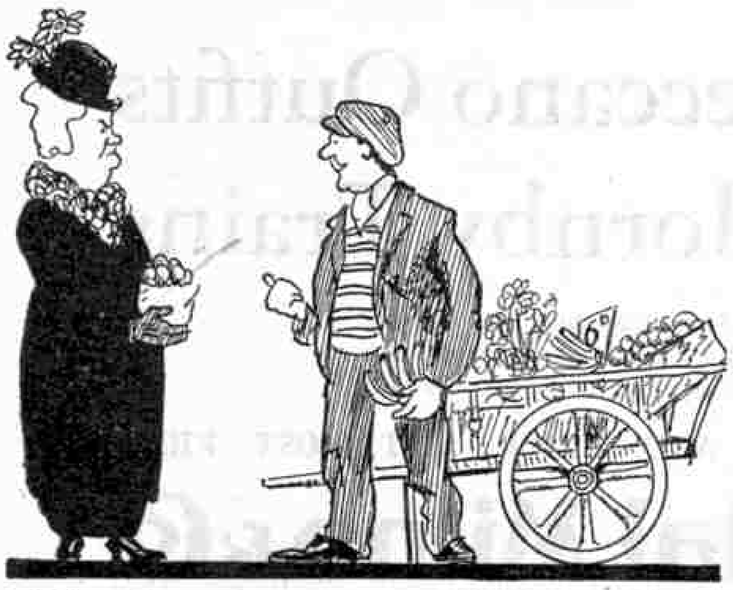
"No, just an ordinary sentence," replied her brother. "Hares eat oats, mares eat oats, and little lambs eat ivy. If you say it quickly it sounds like French or Latin."

"More like Hebrew to me!" exclaimed Geraldine.

You say it; and then see if any of your friends can understand it. Remember to speak very quickly.

* * * *

THE COSTER'S DOZEN



"Look here, my man, you've only given me eleven oranges."

"Yes, that's all right, lady. One was bad, so I threw it away for yer!"

THIS MONTH'S LIMERICK

There was a young fellow of Leigh,
Who fancied queer food for his teigh;
"If I get lots of sauce,
And a chunk of cold hauce,"
He remarked, "That will satisfy meigh!"

* * * *

HE'D LEFT

A man was given a job at a siding, running wagons down an incline. There was only a sleeper at the bottom to stop the wagons, and the manager told him to be careful and keep the brake on.

On the third day four wagons went down at terrific speed, jumped the sleeper, and plunged into the canal.

The manager, anger written all over his face, rushed from his office. The *employee*, however, forestalled him.

"You needn't come grumblin' at me," he said. "I've left!"

* * * *

An inspector was paying his annual visit to the village school. He examined the children in reading and general knowledge, as was his custom, and was very pleased with the answers he received.

After the last question had been asked he rose to his feet and, looking round, remarked genially:

"I wish I was a boy at school again."

He allowed a few moments for this to sink in, and then added:

"Does anybody know why I wish that?"

A small boy stood up.

"Please, sir," he ventured, "It's because you've forgotten all you ever knowed!"

* * * *

ON THE SPOT

The foreman took a certain workman to task for being late. "How is it," he asked, "that George Brown, who has to walk four miles to his work, can always be here on time, and you, who live next door to the works, are always missing a quarter?"

"There's nowt funny in that," retorted the workman, "if he's a bit late in t'morning he can hurry a bit; but if I'm late, I'm here!"

* * * *

DOGMATIC SPEECH

An Englishman, who was a stickler for correct speech, and an American were arguing about queer dialects.

"Why," said the former, "you use the queerest expressions I ever heard. The other afternoon I accosted a Negro and asked him if he thought it would rain, and do you know what he said? He said, 'Little dogs it will and little dogs it won't.'"

The American was puzzled, and the next afternoon met the negro with whom the Englishman had conversed. The Negro scratched his woolly head and said:—

"That ain' what Ah said. Ah just tol' the man that p'ups it would rain and p'ups it wouldn't."

* * * *

A Scotsman went to a solicitor, laid before him a question and asked him if he could undertake the case.

"Certainly," replied the solicitor. "I will readily undertake the case. We're sure to win."

"Ye really think it's a good case."

"Most decidedly, my dear sir. I am prepared to guarantee that you will secure a favourable verdict."

"Ah, well, I'm much obliged tae ye, but I dinna think I'll go tae law this time. You see, the case I've laid before you is my opponent's!"

TRUTH IN ADVERTISING

The proprietor of a provincial underwear store stood in the editorial office of the local newspaper, purple with indignation.

"Look at my advertisement in your wretched paper!" he bellowed to the editor.

"Please be calm, and tell me what is wrong," said the editor soothingly.

"What's wrong?" cried the draper. "Why, I sent in an advertisement reading 'We make men's wear'—and here you have put: 'We make men swear!'"

* * * *

First passenger: "Did you see that conductor glare at me? Just as if I had not paid my fare!"

Her companion: "How dare he! What did you do?"

"Oh! I just glared back as if I had!"

* * * *

"I feel awfully anxious about my wife," said Black to a friend, "She's out in this downpour."

"Oh, she'll be all right," answered White, "she'll shelter in some shop."

"Yes," sighed Black, "that's what makes me anxious. She's got a pound note of mine."

* * * *

A farmer took his wife to a concert, and after listening with apparent joy the pair suddenly became interested in one of the choruses: "All we, like sheep, have gone astray."

First a sharp soprano voice exclaimed: "All we, like sheep"; next a deep voice uttered in a most earnest tone: "All we, like sheep." Then all the singers at once asserted: "All we, like sheep."

"Well, I don't!" exclaimed the farmer to his wife. "I like beef and bacon, but I can't bear mutton."

* * * *

FISHY!

"Here are some trout for you to cook for supper, darling," said Mr. Jones, embracing Mrs. Jones on his return from a day's fishing.

"You can't deceive me like that," returned his wife. "Mrs. Smith said she saw you in the fishmonger's a few minutes ago."

"Of course," said Mr. Jones. "I caught so many that I had to sell half of them!"

* * * *

A good-natured visitor to London lost his watch, and reported his loss to the police.

The chief sympathised with him, and told him that not a stone would be left unturned to discover it.

The following day, while going down the street, the visitor saw a gang of men digging up the road. He stood for a few minutes, and then went up to the foreman.

"Don't bother to look any more, old chap," he said, "It was only a cheap one."

* * * *

A man was shown into a business man's office. His face was a mass of whiskers, beard, moustache, and spectacles.

"Please take a seat," said the manager. He sat down.

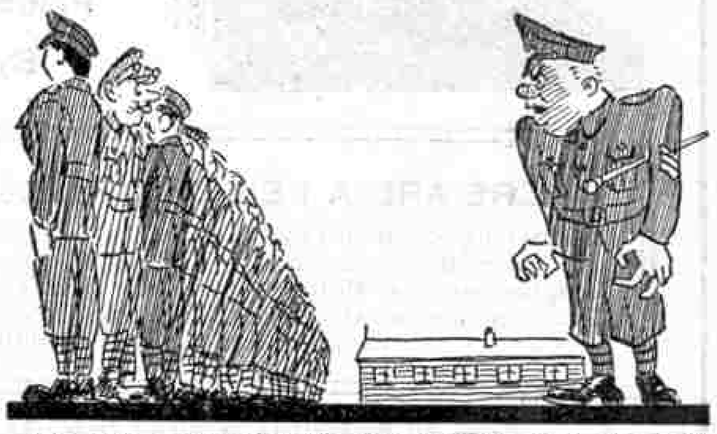
"What did you say your name was?" asked the manager.

"Tom Smith," replied the visitor.

"Ah, yes," said the manager; "your name is familiar. May I ask—er—what is your face?"

* * * *

INNOCENCE



He was a particularly raw recruit, and the drill sergeant was getting very fed up. At last he lost all patience. "Didn't you hear 'About turn'?" he bellowed.

"No," answered the recruit, "Wot about 'im?"

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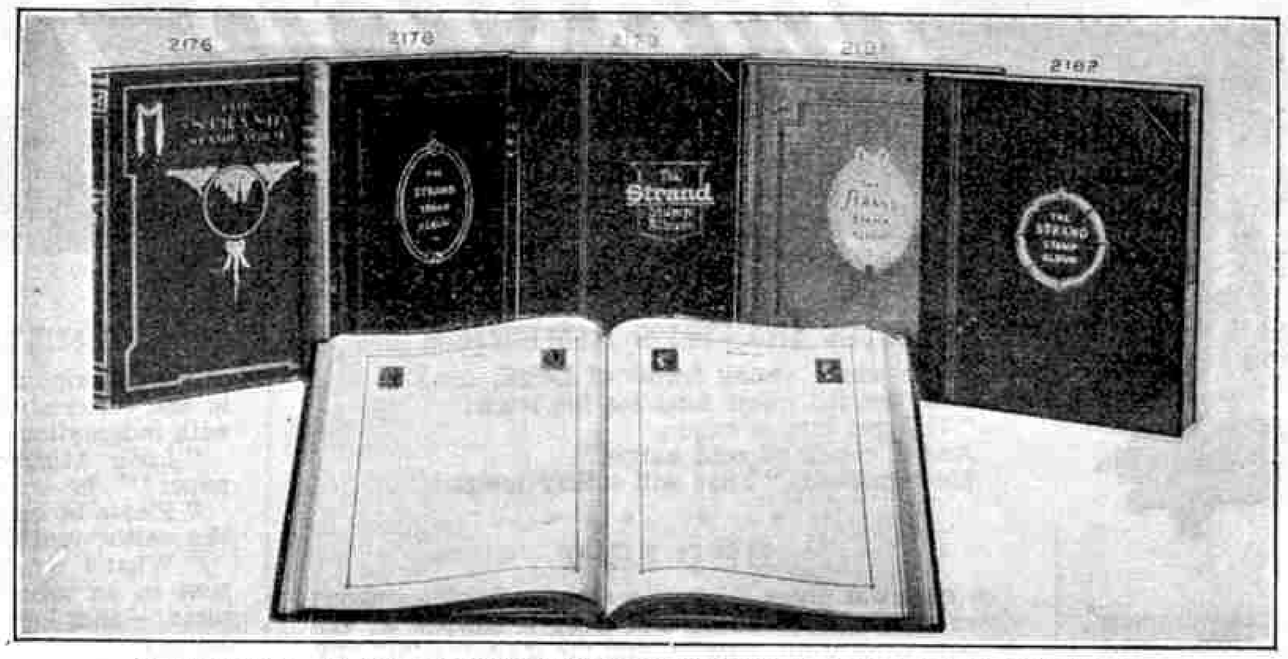

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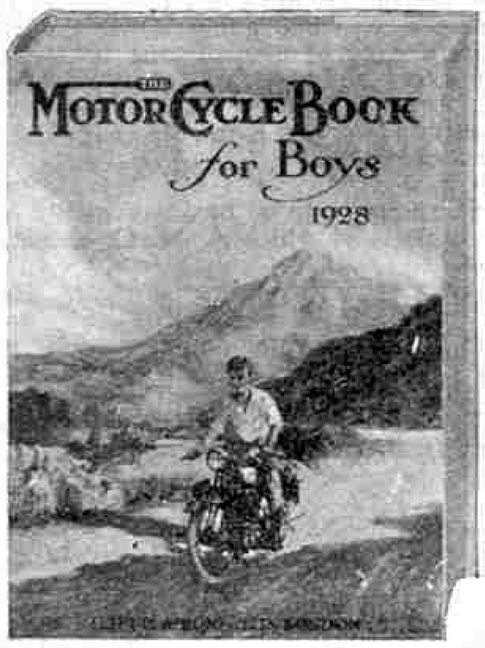

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Stamp Collecting

THE ADVENTURES OF DON QUIXOTE

MANY and varied have been the commemorative stamp issues devoted to men of art and letters, but the most distinctive of all is the Cervantes set issued in 1905 by Spain to celebrate the tercentenary of the publication of the world's most humorous book, "*The Adventures of Don Quixote.*"

The book is purely a burlesque of the ancient stories of knight-errantry, and Miguel de Cervantes-Saavedra, its author, himself declared that his object in writing it was to kill the popularity of the sloppily sentimental tales of early Spanish knights that were proving so bad an influence on the young life of Spain. Whatever Cervantes intended, he gave to the world a book that has been published in 192 different languages, and has achieved undying fame in each.

The Cervantes issue made its appearance in Madrid on 1st May, 1905, and was available for 15 days only for postage within Spain. The set consisted of 10 values, 5, 10, 15, 25, 30, 40 and 50 centimos, and 1, 4, and 10 pesetas. The frame design in each case is the same, the central space being devoted to illustrating one of the many mirth-creating incidents that abounded in Don Q's adventures.

It should be explained that Don Q., as Cervantes' hero is affectionately known throughout the world, from his boyhood up had been greatly addicted to the careful study of doubtful stories of derring-do, and of how the chivalrous knights of olden days spent their time ransacking the world in search of giants and dragons to kill and beautiful maidens seeking release. As the years passed Don Q. became obsessed with the idea that there was still work for knights-errant to carry out, until finally his brain became unhinged and he resolved to go forth to set aright the world's wrongs!

Having succeeded in finding an old suit of armour and a lance, he polished them up ready for his journey. It is true the helmet lacked a vizor, but after a week's hard work a very satisfactory looking affair was created of pasteboard. Unfortunately, Don Q. insisted on slashing his pasteboard vizor rather vigorously with his sword and smash went the product of his labour! Undeterred, he made another, lined this time with strips of tin. With great reluctance he refrained from a further test and tied the vizor to his helmet with green ribbon. Having selected a high-sounding name for his rather flea-bitten-nag—in Don Q.'s eyes his horse was the best favoured in the world—he sallied forth. In the 5c. stamp illustrated Don Q. is seen setting out from his native village.

Our hero's first adventure was the meeting with two country girls at a wayside inn, shown on the 15c. stamp. Don Q. regarded these damsels with the ancient chivalry of his prototypes, but far from being the innocent young girls that he imagined, they had in them more mischief than the demented brain of poor Don Q. could ever conceive. They played up to the adventurer's idea that the inn was a castle of which the innkeeper was the governor, and led him a merry dance.

The story goes on to relate how Don Q. persuaded the innkeeper to confer upon him the order of knighthood, how he watched his armour throughout the night in prayer, using a water cistern in the stable-yard as an altar, and how he slew two carters, who, seeking water for their horses, dared to approach his armour! The actual conferment of the knighthood is illustrated on the 30c. stamp.

A few days later Don Q. fell among thieves and suffered so severe a battering that it would have gone ill with him had not an acquaintance from his home discovered and taken him home. But Don Q. was far from content and ere many moons had passed was up and doing again. For his second journey he engaged the services of a squire, one Sancho Panza, surely the most patient, loyal servant who ever breathed. Their early adventures are shown on the 10 centimos and 10 pesetas stamps, these illustrating the fight with the windmills and the encounter with the enchanted lady, respectively.

Don Quixote and his trusty squire had been jogging slowly across a dusty plain when, breasting a rise in the ground, they suddenly espied a group of 30 or 40 windmills. "Look yonder, friend Sancho Panza, where thou may'st discover somewhat more than 30 monstrous giants which I intend to encounter and slay," cried Don Q. No amount of argument from the trusty squire could persuade our hero that what he declared to be giants were merely windmills, and clapping his spurs into his horse he charged at them. Setting his lance in the rest, and being well covered with his shield, Don Quixote attacked the first mill before him and ran his lance into the sail. The wind then whirled the sail about with so much violence that it broke the lance to shivers and toppled horse and rider over and over on to the plain in considerable confusion! Hurrying up to the rescue, Sancho Panza pulled his master on to his feet and commenced loudly to abuse him, declaring that nobody save one with a crazy brain could have mistaken the windmills for giants. "Peace, friend Sancho Panza," answered Don Quixote, "ever matters of war are, of all others, most subject to continual change. Now, I verily believe and it is most certainly the fact, that the sage Freston... has metamorphosed these giants into windmills on purpose to deprive me of the glory of vanquishing them, so great is the enmity he bears me."

As they were thus talking a cavalcade appeared upon the road headed by two Benedictine monks mounted on dromedaries. Behind them came a coach accompanied by four or five men on horseback, while within the coach was a Biscayan lady on her way to join her husband at Seville. The monks were not in her company and were merely travelling the same road, but scarcely had Don Quixote clapped eyes upon them when he cried: "Those black figures that appear yonder must

(*Continued on page* 1103)

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Stamp Collecting—(*continued from page* 1101)

undoubtedly be enchanters who are carrying off in that coach some princess they have stolen!"

Protesting loudly that Don Q. was probably making an even worse blunder than in his fight with the windmills, Sancho Panza endeavoured to persuade him away, but his master would have none of it. Planting himself in the midst of the highway he cried, "Diabolical and monstrous race! Either instantly you release the high-born princess whom you are carrying away perforce in that coach, or prepare for instant death." Before the amazed monks could answer, he charged and scattered the party. Unfortunately for the would-be knight, a certain squire travelling with the coach took up the cudgels and a hearty set-to ensued, in the course of which Don Q. hit the Biscayan squire such a blow that he lost his stirrups, and with blood gushing from his nostrils, mouth and ears, fell to the ground. In triumph Don Q. leapt from his horse and clapping the point of his sword to his adversary's eyes bade him yield or pay forfeit with his life! Thus ended two of the most sensational of Don Q.'s adventures.

It is impossible in the compass of this short article to deal with all the adventures of Cervantes' hero that are shown upon this set of stamps. The 1 peseta stamp illustrated shows Don Q.'s adventure with the uncaged lions. The remaining stamps deal with Sancho Panza being tossed in a blanket (25c.); Don Q. tilting at a flock of sheep (40c.); Don Q. riding a wooden horse (50c.), and riding in a bullock cart (4p.)

This issue is the sole instance of the provision of a theme for a stamp issue from a book of humour, and we doubt not that the Cervantes Commemorative stamps will remain unique for all time.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with this article and the Stamp Gossip have been prepared.

Stamp Gossip

The First Bobbed Haired Stamp!

One of the most interesting Central American stamps of recent years is the 35 centavos of the Salvador 1925 issue, which shows a young woman with bobbed hair. The young lady on the stamp has the up-to-date forehead "kiss-curl," so it would seem this stamp is a monument to the modern coiffure. But there is more behind the matter than mere tribute to "Dame Fashion."

Knowing that the "bobbed" lady would attract the attention of every housewife, the Government of Salvador took the opportunity to secure a little publicity. Coffee is one of Salvador's most important products, and the woman's head is encircled by realistic olive-green sprigs of coffee-bush. The leaves and the red fruit, which enclose the two seeds (coffee beans), are shown with exceptional clearness, and at the stem of each sprig a scroll is entwined bearing the words "El Mejor Café—The Best Coffee." Thus the housewife is told in two languages that Salvador's coffee is the best.

The Volta Centennial Commemorative

A series of conferences and exhibitions was held recently in the town of Como, Italy, to celebrate the centenary of Alessandro Volta, the famous Italian electrical scientist, from whose name the term "volt," for a unit of electro-motive force was derived. No less than 68 distinguished scientists read papers at the conference, at which practically every country in the world was represented.

Italy took the opportunity to issue another commemorative series of stamps, this consisting of three values, 20c. crimson; 60c. brown-purple; 1 lire 25c. bright ultramarine. The stamp consists of a portrait of Volta on a plain ground, enclosed within a frame. In the top left hand corner of the frame appears a coat-of-arms, while in the bottom left corner the figures 1827-1927, to mark the period, are shown. A tablet at the head of the stamp bears the wording "Poste Italiane," while sandwiched between the value at the bottom of the stamp is the wording "Onoranze a Volta."

Gibbons' 1928 Catalogues

The appearance of the new Gibbons' Catalogues may be said to mark the commencement of the Philatelists' New Year; certainly there is much turning over of new leaves.

The 1928 editions have just come to hand and consist of the now customary three volumes: The Whole World (15/9 post free U.K.), The British Colonies (6/10), and The Rest of the World (10/9). The Whole World volume grows more imposing each year; there are over 1,300 pages of stamp lists, full size illustrations and hints to collectors crowded here into a volume of no more than 2¼ inches in thickness! The hints feature is new and will particularly appeal to young collectors.

It is impossible to convey in a few words all the many price revisions that have been effected; the most important changes are, of course, among the rarer stamps of early issues. Sharp advances also are recorded in the Irish Free State, Rhodesian and S.W. African sections.

To the serious stamp collector, working without a catalogue is almost akin to playing football with a paper bundle; half the interest is missed. A good catalogue enables the collector to identify his stamps, to recognise scarce varieties, to gain a knowledge of stamp values and to have a basis on which to buy, sell or exchange. With those points in mind the keen young stamp collector could do far worse than ask his parents to present him with a copy of Gibbons' 1928 Catalogue as a Christmas gift. For foreign postage, 7d. must be added to the price of the Whole World volume and 3d. to each of the others.

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95	,,	...	2/–	225	,,	...	10/6
105	,,	...	2/4	235	,,	...	11/6
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BECAUSE WE OFFER NO FREE GIFTS, our prices are LOWER than those of any other concern, and our Appro. Books contain hundreds of stamps at EIGHT a PENNY. This is no exaggeration—PROVE IT for YOURSELF by sending for Book F.1—nearly 1,000 stamps from Argentine onwards with **highest** price only ¼d., but more than half at 8 a 1d.

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100 Stamps from 100 DIFFERENT COUNTRIES, including many fine Pictorials, for **9d.** only. (As you know we can supply 100 diff. [not like above] for 2d.)

50 diff. Stamps from **Balkans** only, 7½d.; 100 diff. for 1/7; **Bosnia,** 10 for 4d.; 25 for 1/–. **Bulgaria,** 10 for 2½d.; 25 for 5d.; 50 for 1/–. **Jugo-Slavia,** 10 for 2½d.; 25 for 5d.; 50 for 1/–. **Roumania,** 10 for 2d.; 25 for 4d.; 50 for 9d. **Greece,** 10 for 3d.; 25 for 7d.; 50 for 1/3. **Turkey,** 10 for 3d.; 25 for 7d.; 50 for 1/3. **Holland,** 50 different, incl. rare surcharges and high values, for 1/–.

BRITISH COLONIALS—100 diff., 1/–; 150 diff., 2/–; 200 diff., 3/3; 250 diff., 4/9; 300 diff., 6/9.
Stamp Mounts, 3d. 1,000. **Tweezers,** 9d. pair. **Albums,** from 1/–. **Catalogues,** from 2/6.
SPECIAL—Whit. King's 1927 Catalogue for 3/6, plus 6d. postage.
Postage extra at these low prices on stamps under 5/– in value.

FYFE & GRAY, 99, Corporation Street, BIRMINGHAM
(*Established in the reign of Queen Victoria*).

SHIP STAMPS FREE
to genuine applicants sending 1½d. postage for INTERESTING approvals at lowest prices.
W. M. APPLEBY,
CLARENCE STREET, CHELTENHAM.

Catalogued £5 Offered for 7/6
Complete Set 51 PERSIA, Coronation, 1915 (Ordinary and overprints). Higher values have silver or gold frames. Mint condition.
Grand Xmas Present.
1,000 Different Stamps for 2/9.
High-class approvals against references or deposit. No trash.
Good Stamps are equivalent to **Savings Certificates.**
F. WREN CHILD, ULVERSTON, LANCS.

EIGHT MINT BRITISH COLONIALS FREE: **EIGHT**

Send 2d. (Overseas 3d.) for Postage of 64-page Price List containing hundreds of bargains in stamps (from 1d. up), Albums (from 1/– to £4), Books and Accessories of all kinds, **FULLY ILLUSTRATED,** and receive **FREE, 8 MINT BRITISH COLONIALS,** one each from **KEDAH** (head of rice), Malta, **ZANZIBAR** (just out), Kenya (K. George), **TURKS & CAICOS ISLANDS** (Melocactus), **MAURITIUS** (King), **SOUDAN** (camel), and **CAYMAN ISLANDS,** and **ALL MINT.** Ask for No. 18 Packet.
EDWARD SANDELL, 10-11, Fetter Lane, LONDON, E.C. 4.

HUGE CHRISTMAS OFFER FREE!

This month I have decided to give all applicants an extraordinarily fine **Gift** with my best wishes for a happy Xmas. It is a grand collection of **115 Different Stamps** including such **Seasonable Varieties as Iceland, Poland, Newfoundland, Scandinavia,** splendid **Sets of Finland** and of **Russia, Switzerland** and such places which speak of **Snow and Christmas. A Postcard will do !** But if you would like **in addition to all the above, a fine Magnifying Glass in Folding Metal Frame,** just send 2d. for postage. Ask for approvals, and **get your Christmas Presents from Matlock !** My latest list is crammed with **Bargains and Gift Offers,** and **your Order is sent by return always !**
VICTOR BANCROFT, MATLOCK, ENG.

---

50 VARIETIES PORTUGAL AND COLONIES ALL DIFFERENT. ONLY 4½d.
We make this special offer to all new applicants for our approval sheets. We allow big discounts off catalogue prices so that by selling our stamps you can obtain several varieties for your own collection free, and in addition if you sell to the value of 2/– and enclose a 1½d. stamp we shall send you a
SPLENDID TRANSPARENT PERFORATION GAUGE FREE.
HAVE YOU THESE ? Inhambane, 12 vars., cat. 3/4, only **1/3.** 5 vars., cat. 1/8, only **7d. Tete,** 8 vars., cat. 2/7, for **10d.,** 5 vars., cat. 1/6, for **6d. Quelimane,** 8 vars., cat 2/8, for **10d.** 5 vars., cat. 1/6, for **6d.** All the above sets are from out of the way places. We offer the 28 varieties catalogued by S.G. 1928 at 8/7 for only **2/6.**
Ask to see our pictorial approval books of Nyassa, Mozambique Co., Vasco da Gamas, etc. Big discounts off catalogue prices.—**H. and G. H. JOPLING, 44, RISCA ROAD, NEWPORT, MON.**

---

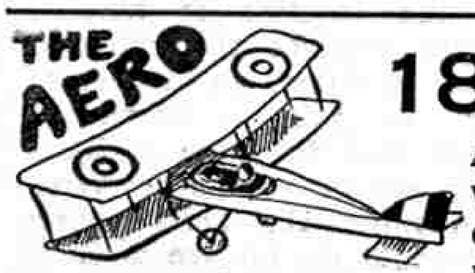
10 Rare Stamps, Catalogued 10/-
250 Mounts, and **250 Unpicked Stamps, Price 1/–** Post Free. Unused **Ceylon War Stamp, Free.**
RENDALL BROS. (Dept. F),
ENDSLEIGH, HIGHER COMPTON, PLYMOUTH

UNIQUE 100 STAMPS FREE

including Gold Coast, Wallis Islands, Ceylon, China, New Caledonia, Malay, Travancore, French Guinea, Japan, etc. Only to applicants for my famous ½d. Approvals. Without approvals, price 6d.

FLEMING,
St. Winifreds, Christleton Rd., Chester.

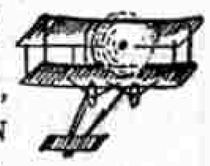
COMPLETE STAMP COLLECTOR'S OUTFIT FREE
1.—Metal **Watermark Detector** with printed instructions.
2.—A superior **Perforation Gauge.**
3.—A Duplicate **Album.**
4.—Packet of Best Quality **Stamp Mounts.**
5.—Packet of **Transparent Envelopes** with gummed flaps.
6.—Packet of different **Superior Stamps,** catalogued over 4/–.
In order to circulate our **Half-Price Approvals** and latest **Bargain List,** the above outfit will be sent **FREE** and **Post Free** to all genuine applicants for approvals (Abroad 4d.) Mention Outfit.
HORACE MILLER & CO., Whitstable, KENT.



PACKET

Send addresses of Stamp Collecting Friends and receive an extra Set Free.

18 Air Post and Triangular Stamps Free



A WONDERFUL PACKET OF GOOD CLASS STAMPS ONLY including **ECUADOR** (Pictorial), **NEWFOUNDLAND** (Caribou), **VENEZUELA** (re-engraved), **GRAND LIBAN & SYRIA** (unused pictorials), **PALESTINE** (fine), **POLAND** (new issue), **UNION OF S. AFRICA** (bi-coloured pictorials), **MALAY** (Tiger), **CHINA** (Pictorial issue), **HUNGARY** (War, etc.), **NIGER** (new issue), **INDO-CHINA** (bi-coloured), **CZECHO-SLOVAKIA** (pictorial), **CEYLON** (obsolete), **MOZAMBIQUE** (pictorial), etc. Post Free **4½d.** only, and in addition I will present **FREE** to all who ask to see my Approval Sheets a **WONDERFUL GIFT OF 18 AIRPOST,** Aeroplane design and **TRIANGULAR STAMPS.**

H. C. WATKINS (M. Dept.), GRANVILLE ROAD, BARNET

1,111 Try the Cheapest and Best 1,111

Method of adding to your collection. When you buy PACKETS you buy DUPLICATES. I will send you a book of 1,111 different stamps from which you may select any 100 for 3/–.

BUY ONLY THOSE YOU REQUIRE.

H. HARDY,
1,111 285, Archway Road, London, N.6. 1,111

Artts Ccegillnot Ampsst Adoty-

What do these four jumbled words mean? Send your solution, ask to see our approval sheets of Stamps, and enclose two penny stamps for postage, &c. If your answer is correct we will then send you **absolutely free** 25 Asia **or** 10 Ceylon **or** 50 Austria **or** 10 Mozambique **or** 100 all different.

M. C. FLORICK,
179, Asylum Road, London, S.E.15.

PLEASE U PARCEL CONTAINS

200 Foreign Stamps. 250 Stamp Mounts.
Long set of Japan. Scarce Siamese Set and Perforation Gauge.

Price 6d. the five lots. Only one parcel allowed at this price, extra parcels 2/– each.

G. P. & F. J. CRANWELL,
202, HERMON HILL, LONDON, E.18.

FREE to Stamp Collectors

To introduce my **Farthing Approvals,** all applicants for a selection will receive absolutely free either of the following (your choice) :— 1. Sixpenny Jamaica Pictorial; 2. Three Armenian Pictorials; 3. Ten Soviet Russia.

J. V. WYK,
22, Carrington Road, Flixton, Manchester.

"PHIL," 20, CASTLE STREET, DOVER.

1,000 Stamps, **6d.**; 300 all different, **6d.**; 40 Central and South America, **6d.**; 50 French Cols., **6d.**; 40 Portuguese Cols., **6d.**; 20 Italian Cols., **6d.**; 25 Irish, **6d.**; 25 British Official, **6d.**; 25 Bulgaria, **6d.**; 25 Siam, **6d.**; 30 Roumania, **8d.**; 500 all different, **1/–**; 1,000 all different, **3/–**; 100 French Cols., all different, **1/–**; 200 French Cols. all different, **2/6.**

Postage 1½d. extra.

COLONIALS wanted per 100 or 1,000.

HAYTI CENTENARY – 100 Stamps FREE

This superb set of Pictorial Hayti, etc., free to all genuine buyers from the **BLUE LABEL APPROVAL BOOKS.** Ask for "Hayti Gift," and send postage.

The Blue Label Approval Service (F. S. Coryn), St. Vincent, Island Wall, Whitstable.

SPECIAL XMAS BARGAIN

111 different mint and used BRITISH COLONIALS, including Barbados, Bermuda, Caymans, Ceylon (war), Fiji, Hong Kong, Kenya, Leewards, Malta, Mauritius, Montserrat, Morocco, New Hebrides, Straits, Travancore, Turks & Caicos Isles, Zanzibar, etc., etc. Post Free 1/1½. A BARGAIN WELL WORTH WRITING FOR.

J. & F. RYDER,
38, Clifford Street, Brooks's Bar, Manchester.

FREE 30 BRITISH COLONIALS FREE ALL DIFFERENT

Including BARBADOS (unused), set of 6 Ceylon, INDIA 1 RUPEE (now obsolete), Jamaica (set of pictorials), NEW ZEALAND (LITHOGRAPHED WMK), SOUTH AFRICA (1d. & 2d. in English & Dutch, new printing), etc., etc. FREE to all collectors who send P.C. requesting appros.

BEDELL & WYATT,
KNUTSFORD ROAD, WILMSLOW, CHES.

35 FREE

A handsome gift of good class stamps only incl. rare used **LUXEMBURG,** C. America, etc. Over 20 UNUSED pictorials from **MOZAMBIQUE,** Ukraine, **TOGO,** set 3 **BELGIUM** Parcel Post, **VENEZUELA,** sets British and French Cols. The finest packet I have ever offered. Sent FREE to responsible applicants for my "Orange" approval books, enclosing 1½d. for postage.

PORTER, 20, Sydner Road, Stoke Newington, N.16

Stamp Advertisements continued on pages 1098 *and* 1127

A Christmas Stamp Contest

For several years past a number of European countries have made a point of issuing special sets of postage stamps at Christmas time to raise funds for charity. The practice has been to charge a stated sum, usually the equivalent of a penny or half-penny, above the face value of the stamps and to allocate the additional funds thus secured among deserving institutions, principally those engaged in child welfare work and succouring the aged. Principal among the countries following this custom are Switzerland and Holland. The issues are usually confined to the smaller denominations in great demand for postal use.

The extraordinary effectiveness of this method of raising money is revealed by the figures of a recent year when over 6,000,000 stamps were sold in Switzerland, netting more than £12,500 for the charities concerned. A specially interesting feature of the allocation of the proceeds in Switzerland is that 10 per cent. is given to the Postal Employees' Benevolent Fund in recognition of the enthusiastic work of the P.O. workers in the distribution of the stamps.

Both Switzerland and Holland have made a point of producing designs worthy of a good cause and, strangely enough, the theme for the designs of both countries springs from the same source, the arms of the various cantons or provinces making up the country, being used in turn. The designs are reproduced on the stamps in true heraldic colours, and we illustrate a specimen of each of the Dutch and Swiss 1926 issues. The arms are of North Holland and Lucerne respectively.

These few notes on Christmas issues lead admirably to the subject of our stamp competition this month, A DESIGN FOR A CHRISTMAS STAMP.

In this contest prizes will be awarded to the competitors who submit the best designs for a Christmas stamp to be issued from "Meccanoland." The choice of design is left entirely to the individual competitor, but the name "Meccanoland" and the value 3d., must be incorporated. It should be assumed that the stamp is to be issued to raise funds to provide poor children with Meccano Outfits and Hornby Train sets, but it is optional to include something symbolical of this aim in the design. Colours may be used if desired, both paints and crayons being eligible.

The competitors will be divided into two sections, A for those aged 16 and over, B for those under 16. Prizes of Meccano goods, or stamps chosen from lists of any of our advertisers, to the value of £1-1s. and 10/6 respectively, will be awarded to the best two entries in each section. Entries must be addressed to "Xmas Stamp Competition, Meccano Magazine, Binns Road, Liverpool," and sent to reach this office not later than 31st December. Overseas closing date, 31st March, 1928.

Competition Results

Home Results

23rd Photo Contest

First Prizes: Section A, G. S. MARSH (Blackpool); Section B, E. D. BAILEY (Romford). Second Prizes: Section A, H. J. LEWIS (Romford); Section B, C. W. PRICE (Beckenham). Consolation Prizes: J. E. M. COOMBS (Bristol); J. A. S. YONGE (Twickenham).

September Essay

First Prizes: Section A, H. SHAFFER (Southport); Section B, H. J. BARNES (Tamworth). Second Prizes: Section A, H. G. VIVIAN (Llanelly); Section B, J. R. WOOLFORD (Teddington). Consolation Prizes: F. H. CULVERHOUSE (Sheffield); PEGGY HAWKS (Shortlands, Kent).

Doublets No. 3

First Prize: L. A. WOOD (Cleethorpes, Lincs.); Second: A. TURNER (Grays, Essex); Third: G. E. WILLIAMS (St. Helens); Fourth: F. DARBYSHIRE (Darlington). Consolation Prizes: A. E. CLARK, M.A. (Leix, Ireland); J. B. GREENALL (Nottingham); S. MAY (Beckenham, Kent); R. F. NEWTON (Clapton, E.5); M. PRESTON (Cheltenham); R. S. WILSON (Barrow, Lancs.)

Aeronames Competition

First Prize: A. W. TEMPLE VALE (Streatham Hill, S.W.16); Second: A. E. DAVIS (Boston, Lincs.); Third: R. V. SMITH (Eltham, S.E.9); Fourth: A. LUPSON (Purley, Surrey). Consolation Prizes: R. H. BENNETT (Chingford, Essex); S. C. GOULDSMITH (Bournemouth); J. H. C. HUNTER (Blackheath, S.E.3); R. PARRY-GABBOTT (Hildenborough, Kent); V. PRATT (New Southgate, N.11).

Overseas Results

May Crossword Puzzle

1. D. G. OCHLERD (Singapore, S.S.); 2. LIM TAM CHONG (Kuala Lumpur, F.M.S.); J. G. GUANADURAI (Trichinopoly, S. India); Consolation Prize: E. HOLDER (Trinidad, B.W.I.)

May Essay

First Prizes: Section A, G. B. HAWKINS (Vancouver); Section B, P. D. MARSH (Cape Town, S.A.) Second Prizes: Section A, M. J. DESAI (Navsari, India); Section B, E. SMITH (Montreal, Canada).

22nd Drawing Contest

First Prizes: Section A, R. J. GLASS (Paris); Section B, S. B. TOMKINSON (Vancouver). Second Prizes: Section A, G. ROBERTS (Sydney); Section B, T. S. RICHARDS (Capetown).

Filming the Aurora Borealis—

(*Continued from page* 1051)

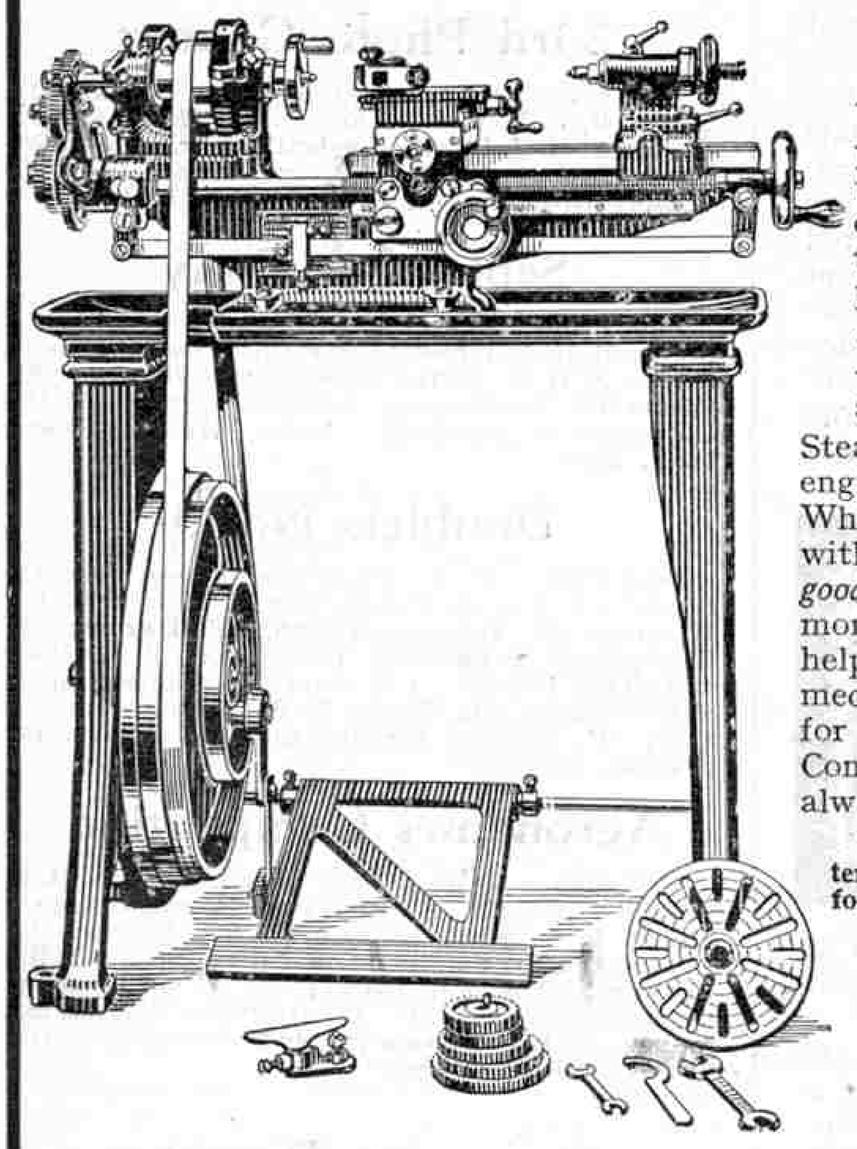
as if driven by a storm. It was an endless phantasmagoria of sparkling colour, surpassing anything that one can dream."

As to the nature of the Aurora Borealis, Professor Stoermer declares that they consist of cathodic rays, which are analogous to radium or to Röntgen rays. They are composed of electric particles emitted by the sun at a speed of many thousand miles per second, and so small that several millions, placed side by side, would not cover an inch. It is the magnetism of the earth that draws these electrical rays to the dark regions of our planet, hence they are only to be witnessed near the Arctic and Antarctic regions.

These wonderful Arctic lights do not occur high up in the heavens. According to the calculations made by Professor Stoermer, the majority of Aurora are to be observed from 60 to 72 miles above the ground. They frequently extend a considerable distance, the rays of one, photographed last March, reaching a length of 300 miles.

Own a fine Drummond Lathe

Join the model engineering ranks, and make real working scale models.



The Drummond 3½-inch Treadle Lathe. Opposite, the Lathe is shown at work on a casting.

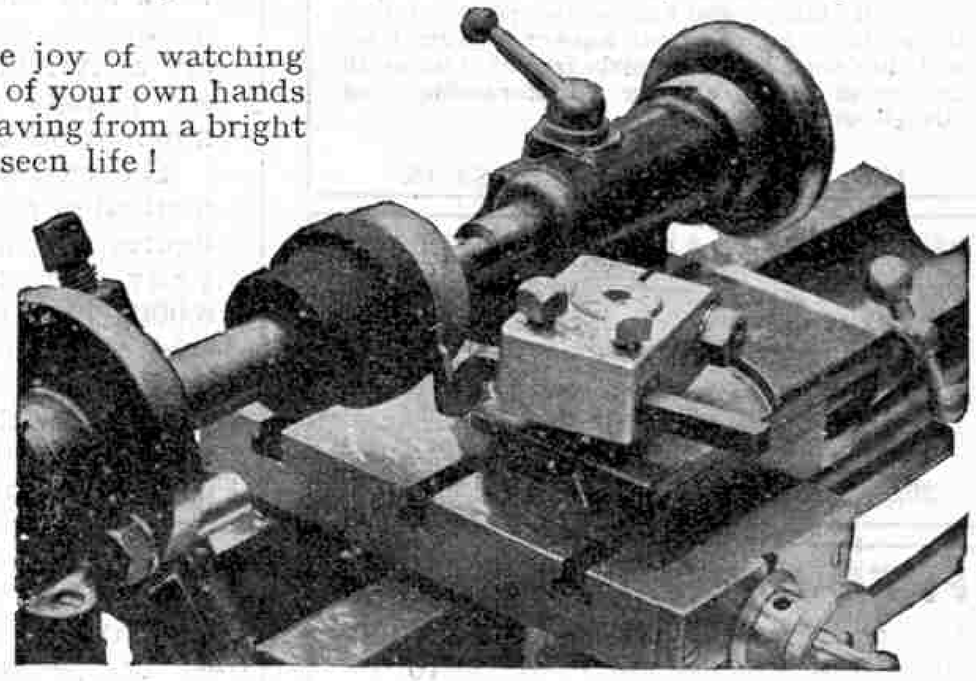
The lathe makes a workshop. You can muddle along without one, but for real, engineer-made models, a lathe is essential.

You can be proud of your Drummond—it's a tool you can enthuse about. It can be your very valuable assistant, too. There is no sense in spending all your time and trouble pottering about without proper tools—get a good lathe to start with, and you can use your skill to best advantage. The Drummond will see you through the trickiest job.

If you haven't known the joy of watching a lathe—under the control of your own hands—peel off a curling steel shaving from a bright shaft—then you haven't seen life!

Steam engines, petrol engines, cranes, locos! What a field you can cover with a lathe! But get a *good* lathe. The Drummond lathes have been helping thousands of mechanics to do good work for twenty-four years. Continually improved—always the best obtainable.

Why not get our interesting lists with full information? Sent post free.



Post this Coupon

To **DRUMMOND Bros. Ltd., East Hill, Guildford.**

Please send me lists of your 4-in. and 3½-in. lathes, post free.

Please print distinctly. If without letter, send unsealed, for ½d.

Name .....

Address .....

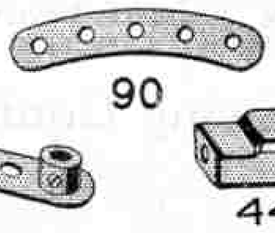
.....

MECCANO
ACCESSORY PARTS

The parts that form the Meccano system are real engineering parts in miniature. Any movement known in mechanics may be duplicated with these parts, including gear boxes and differential gears for Motor Cars, drive-changing and reversing gears for Steam Shovels, Ship Coalers, etc., and other interesting mechanisms.

Already known as the greatest constructional system in the world, Meccano has now an additional attraction—the steel parts are brightly enamelled in colours. Thus, Meccano models are not only accurate reproductions of big engineering structures but they are also beautiful in appearance and are more realistic than ever.

The parts illustrated are a representative selection. Their prices are given below.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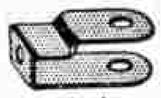
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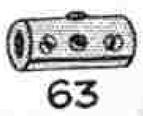
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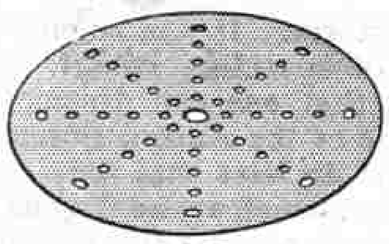
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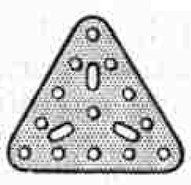
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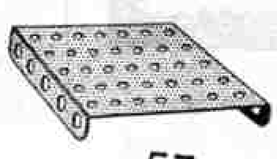
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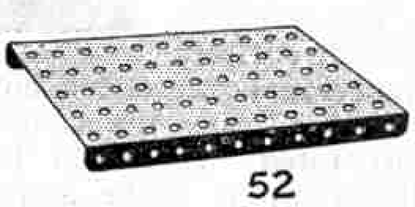
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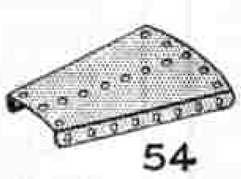
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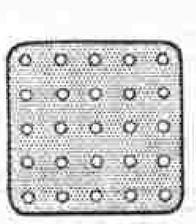
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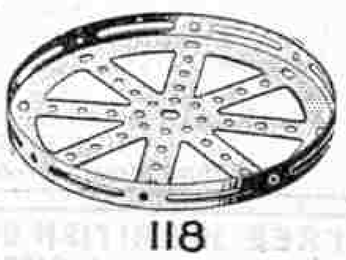
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23A

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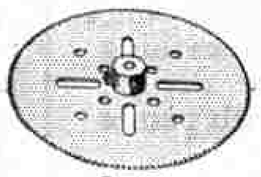
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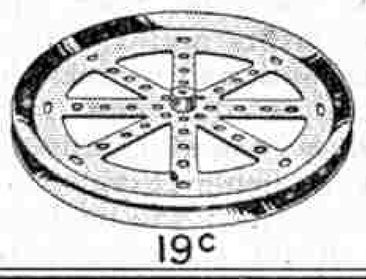
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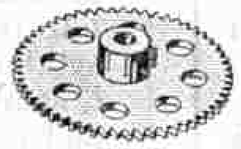
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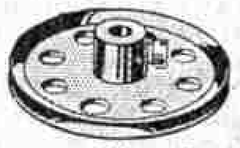
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90A

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3

126

No.		s.	d.
3	Perforated Strips, 3½″ long	½ doz.	0 4
12	Angle Brackets, ½ × ½″	... doz.	0 6
19c	Pulley Wheels, 6″ dia.	... each	2 6
21	„ „ 1½″ dia.	... „	0 6
23	„ ½″ without set screw	„	0 2
23a	„ ½″ with set screw	„	0 4
24	Bush Wheels	„	0 6
27a	Gear Wheels, 57 teeth ...	„	0 9
27b	„ „ 133 „ ...	„	1 6
30	Bevel Gears	each	0 10
32	Worm Wheels	„	0 6
44	Cranked Bent Strips ...	„	0 1
50	Eye Pieces	„	0 2
52	Flanged Plates, 5½ × 2½″ ...	„	0 5
53	„ „ 3½ × 2½″ ...	„	0 3
54	Flanged Sector Plates ...	„	0 3
59	Collars with Set Screws ...	„	0 2
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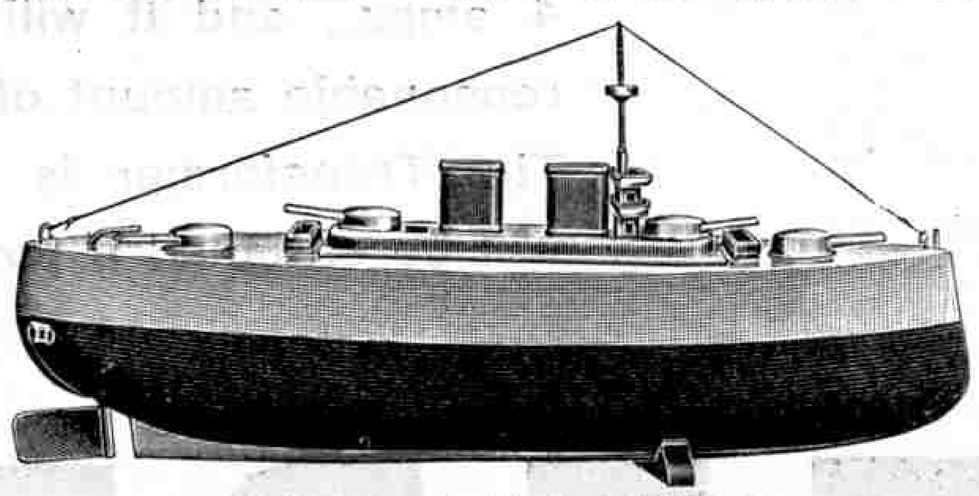

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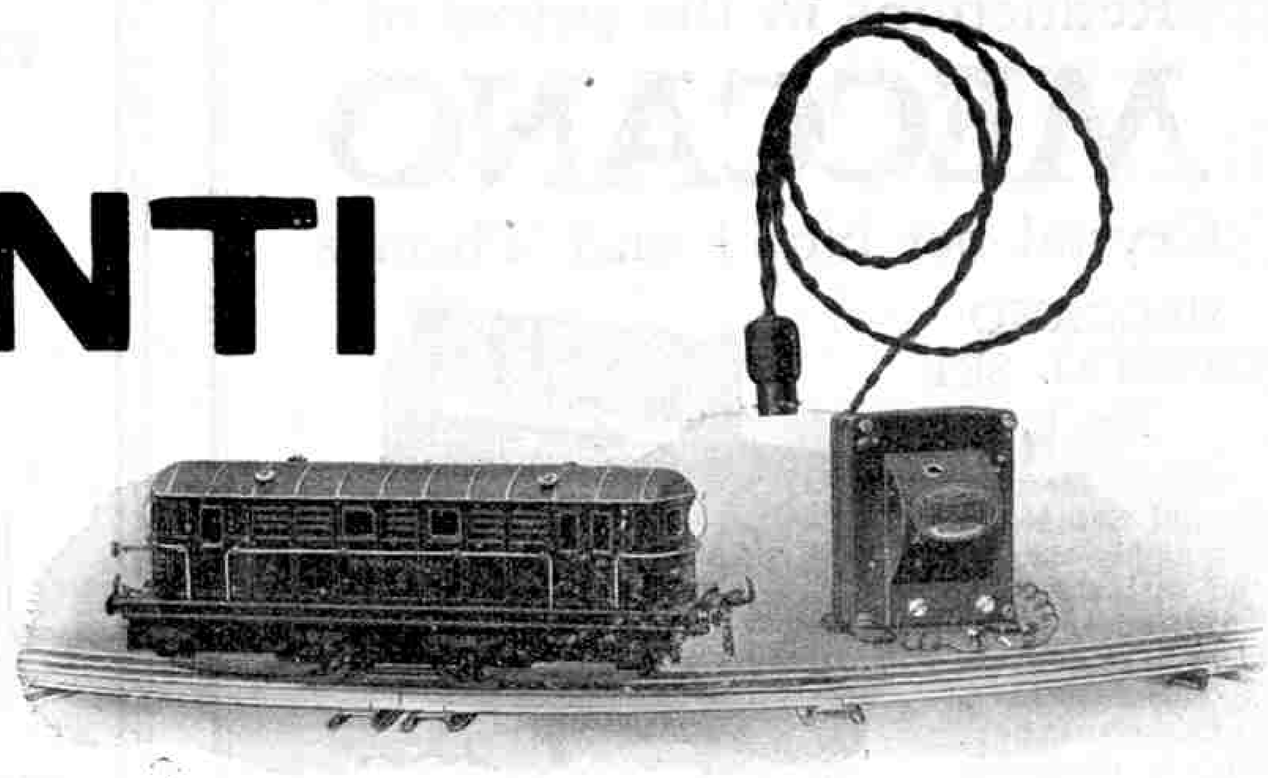

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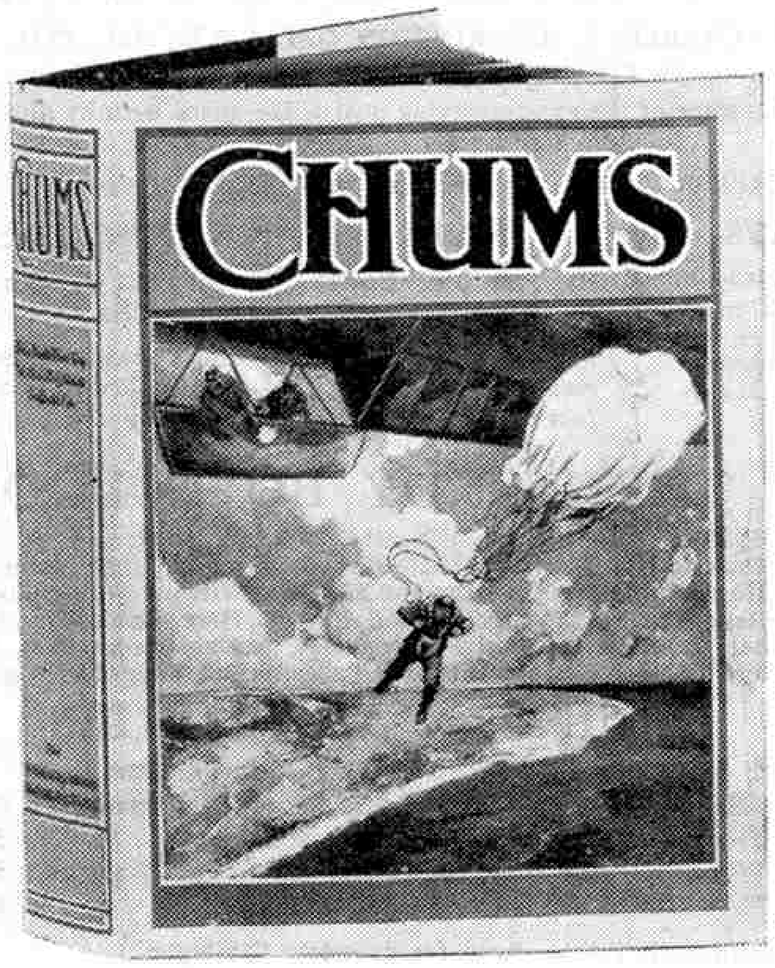

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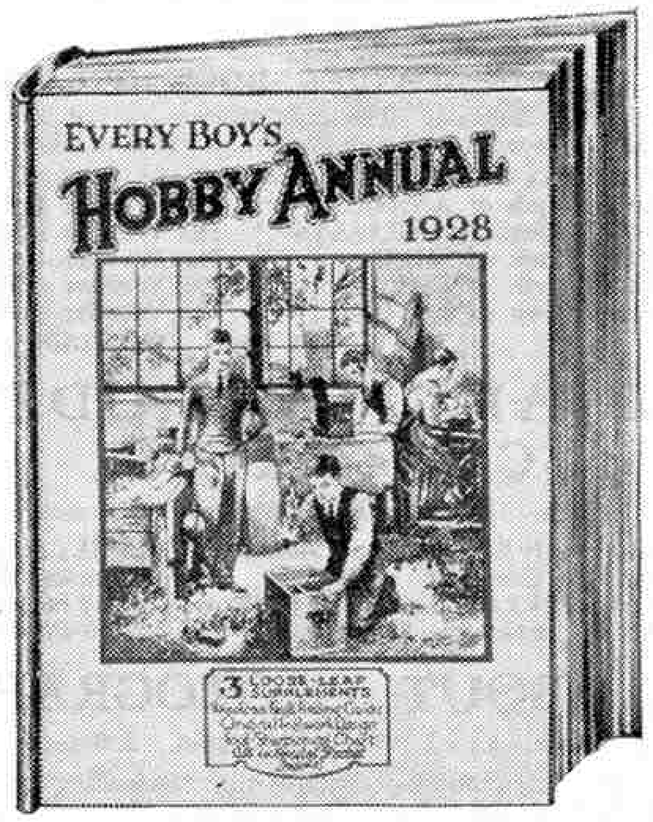

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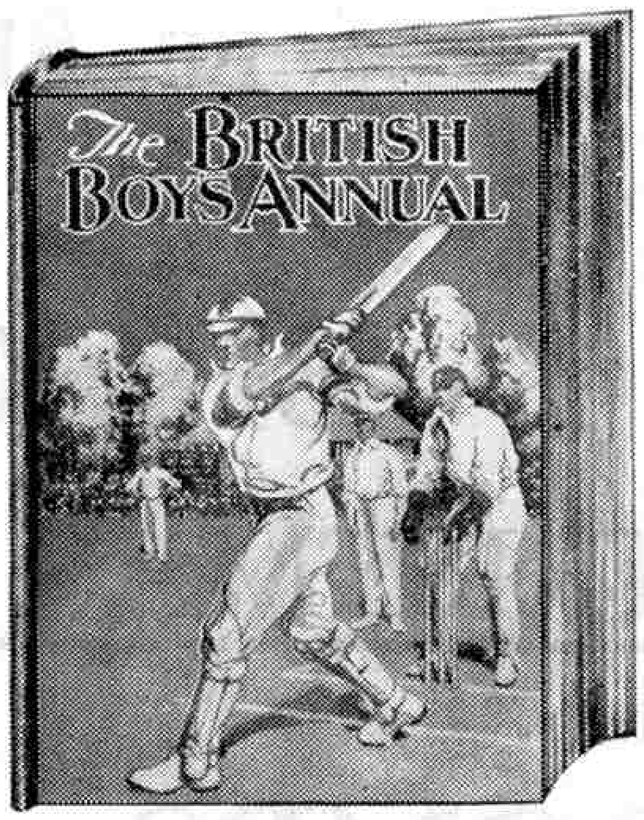

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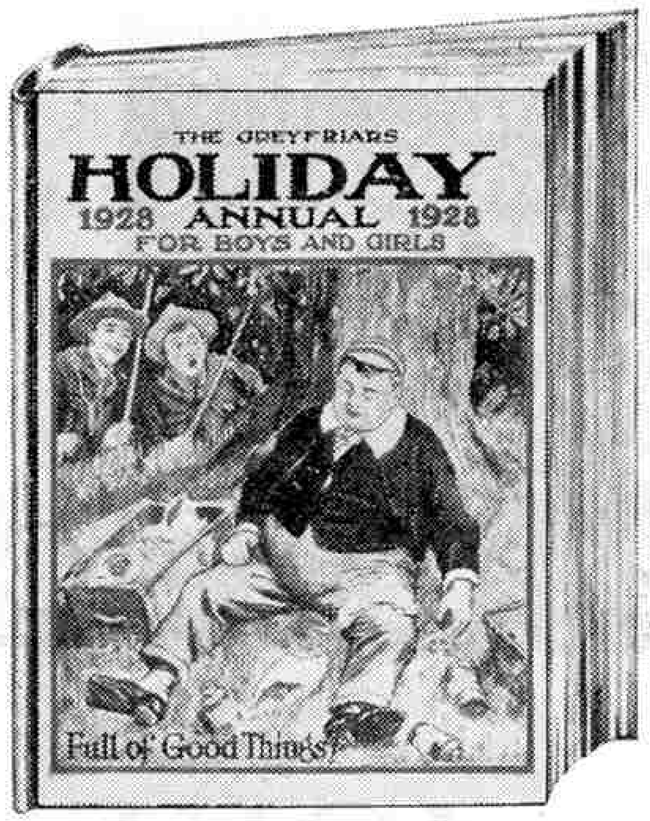

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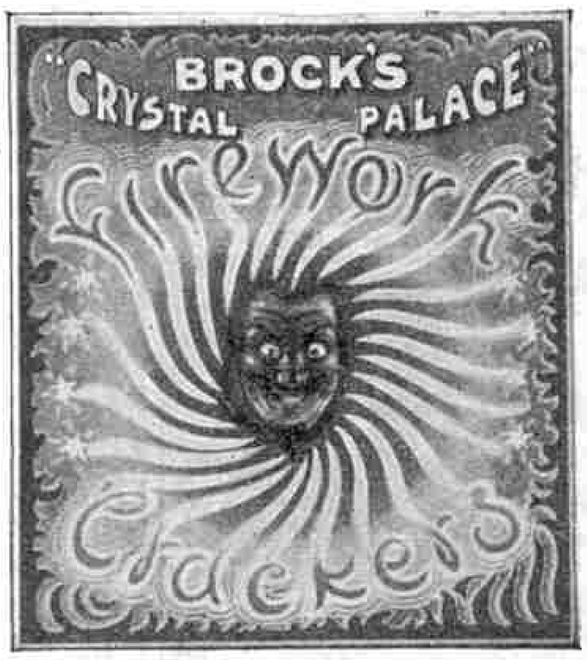

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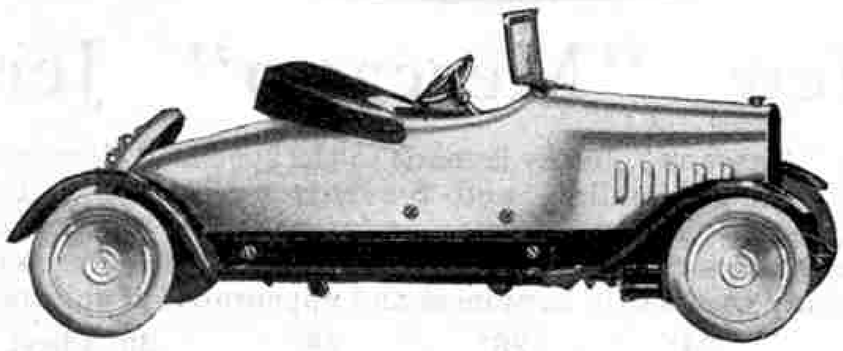

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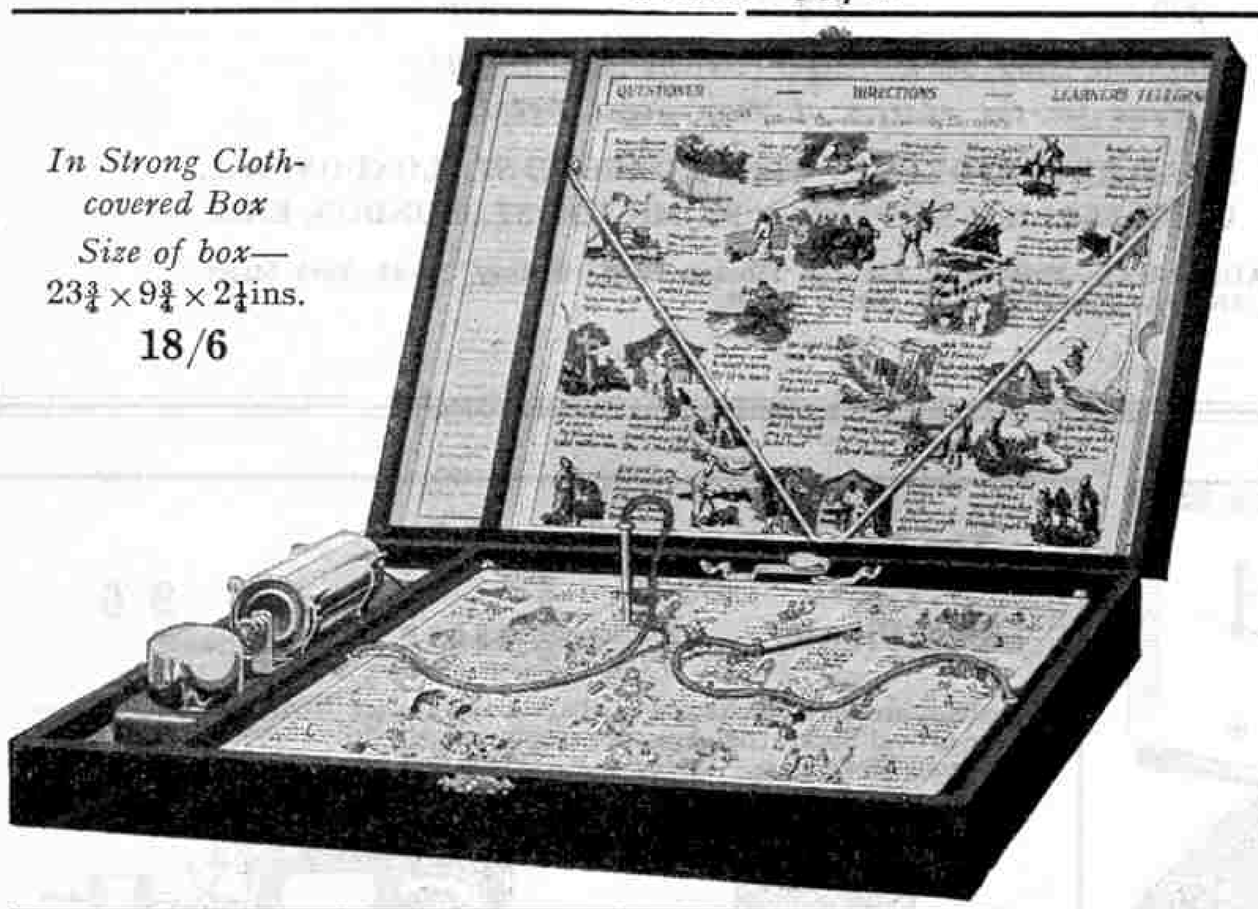

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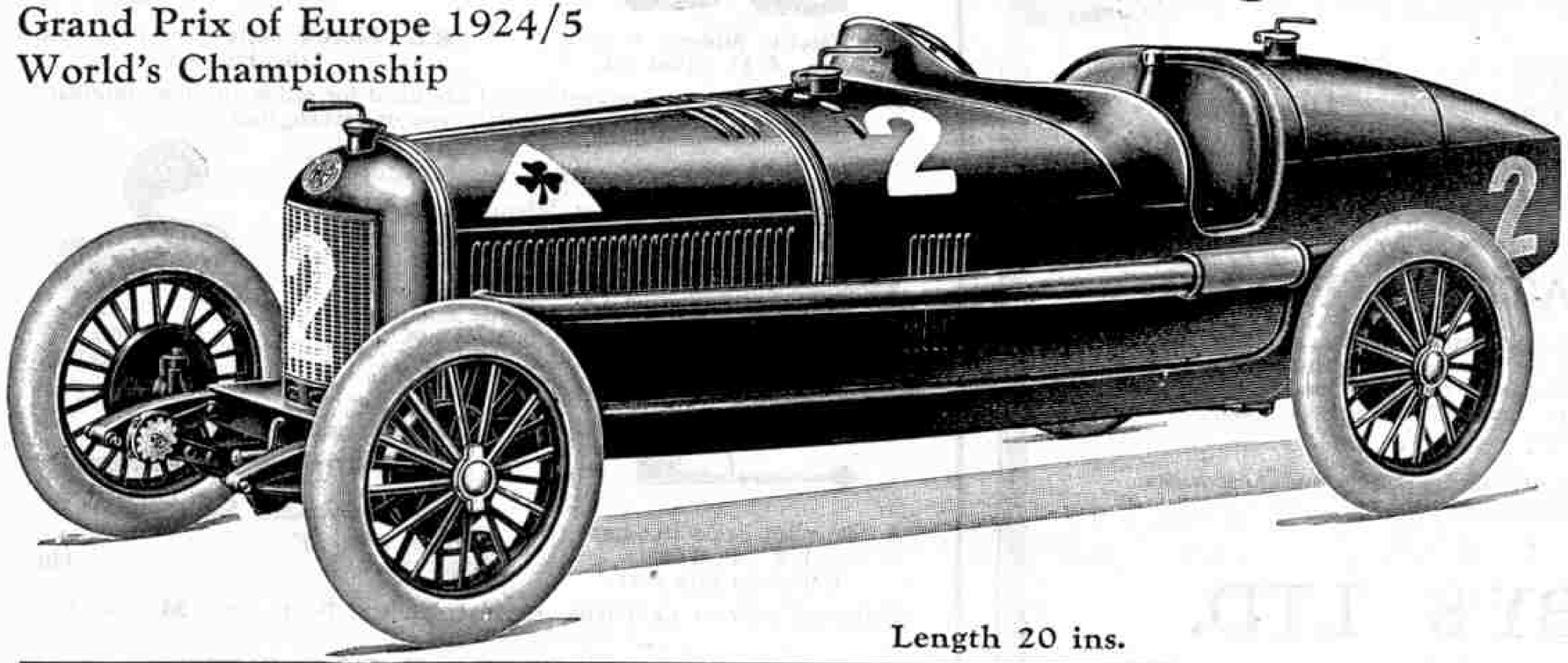

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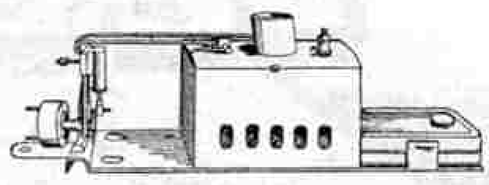

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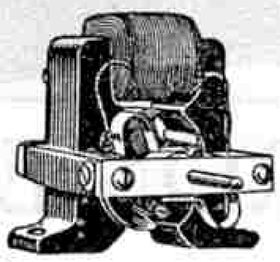

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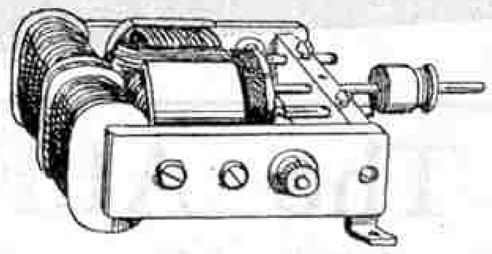

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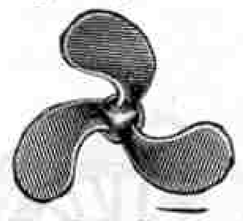

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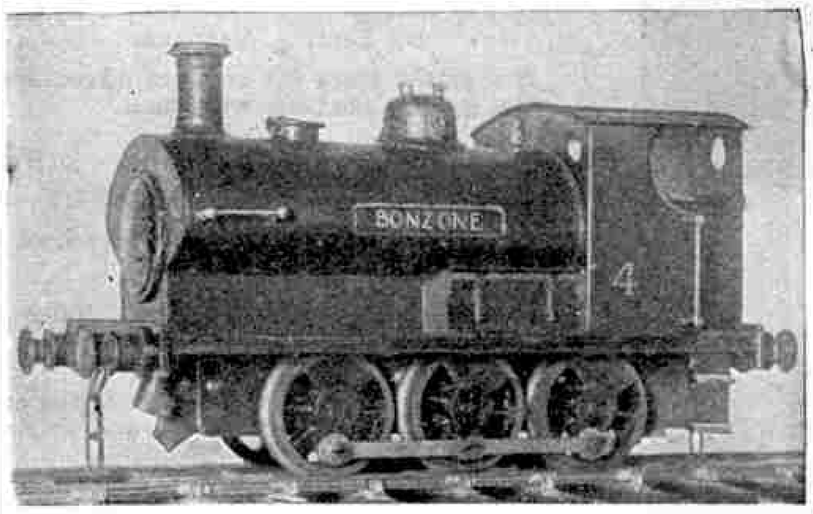

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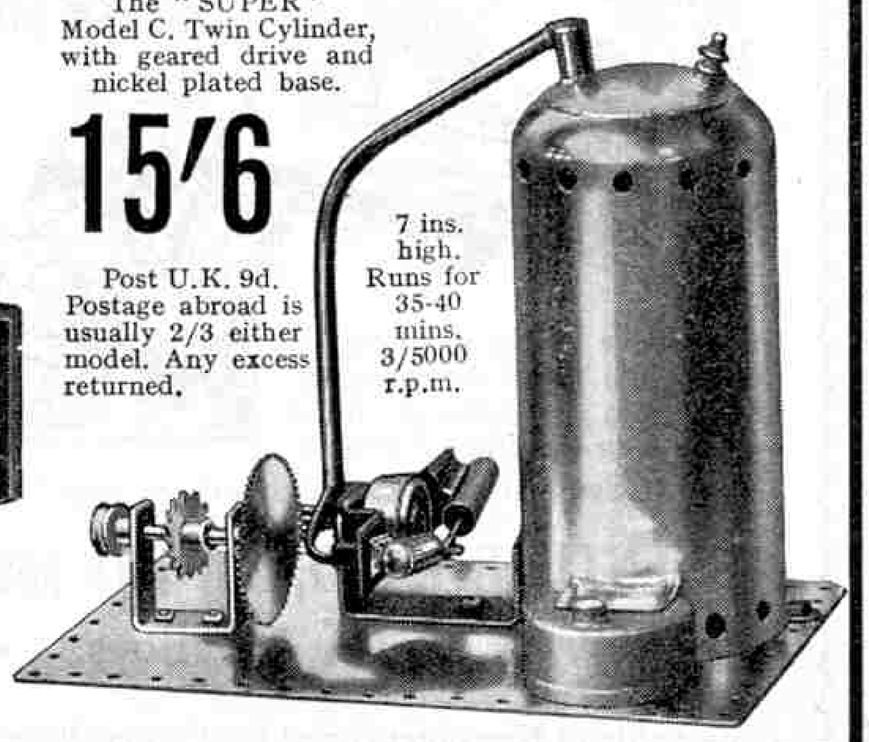

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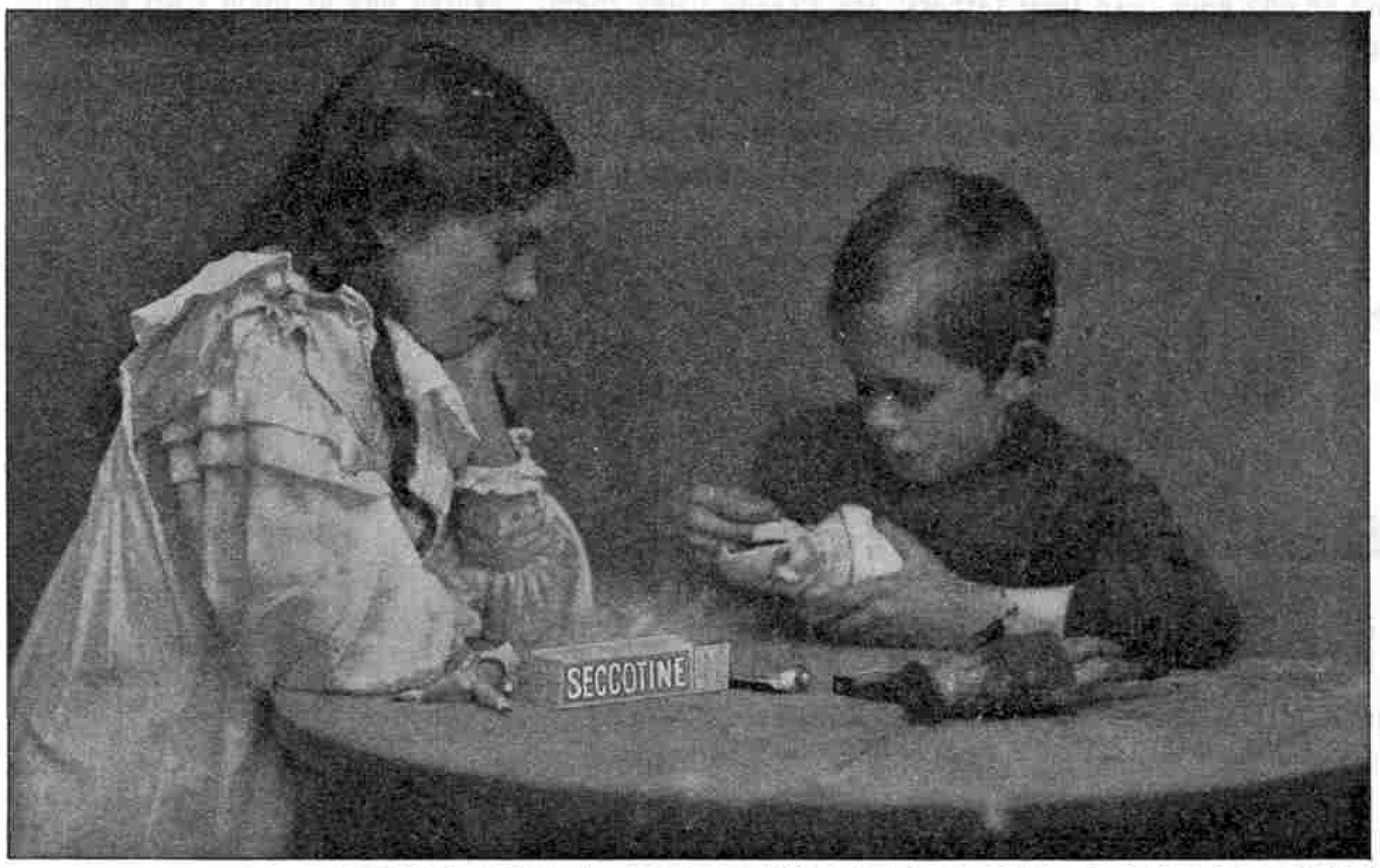

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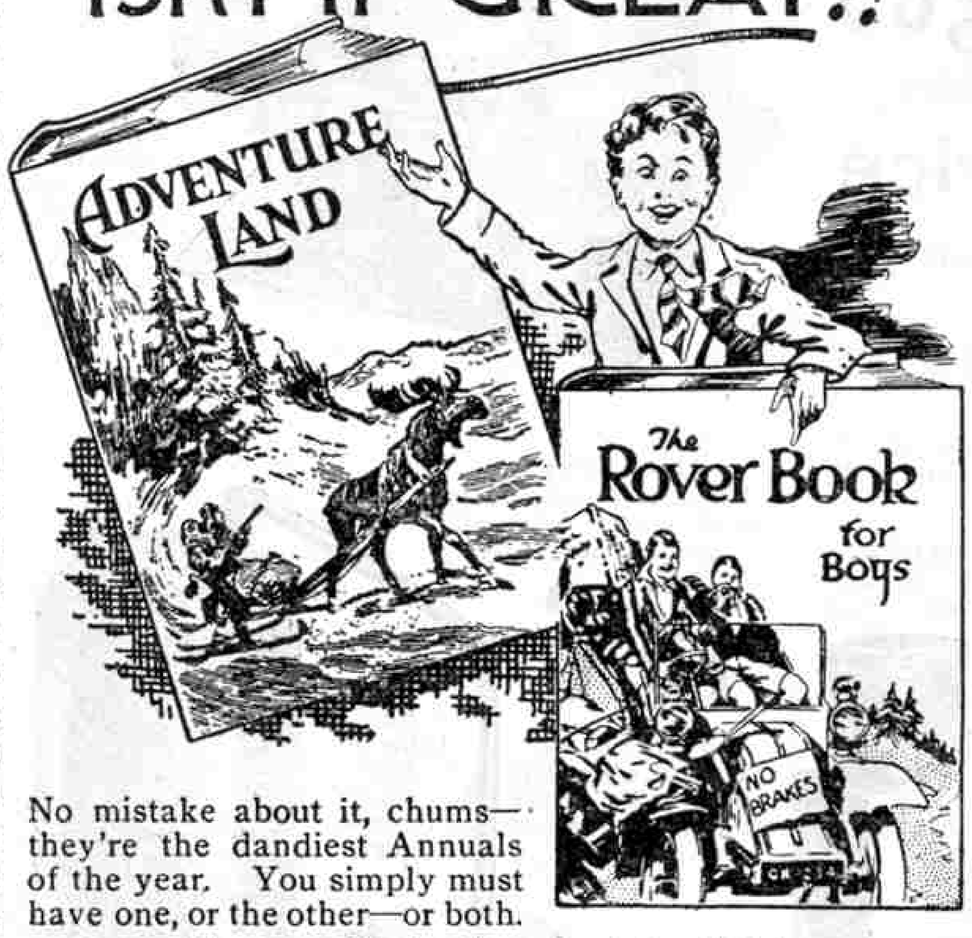

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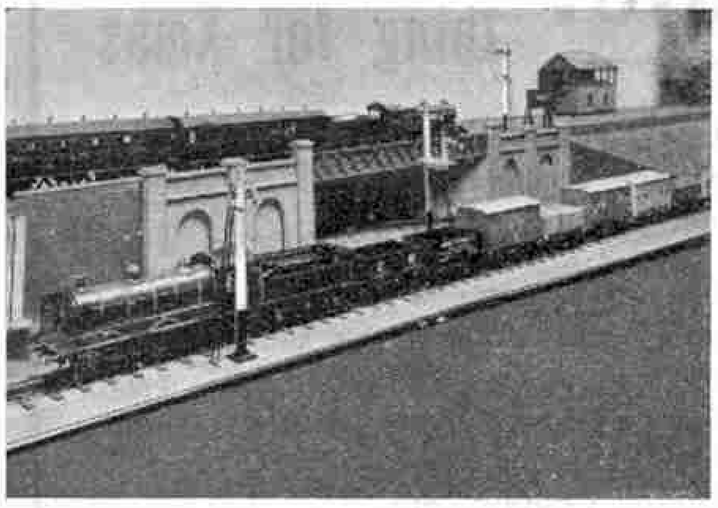

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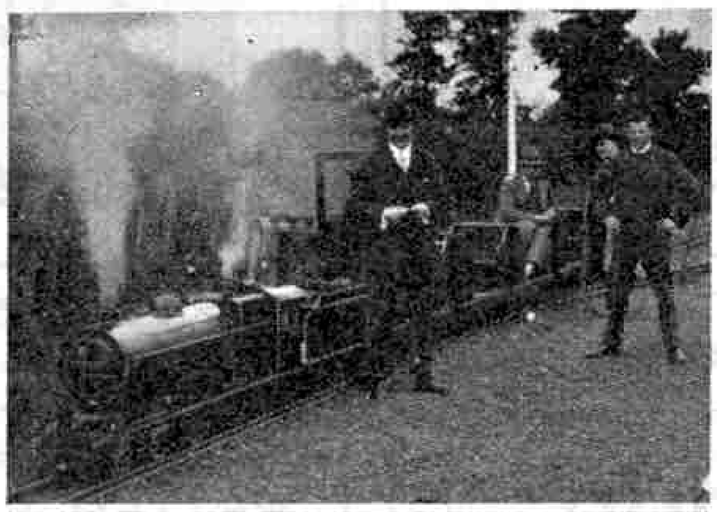

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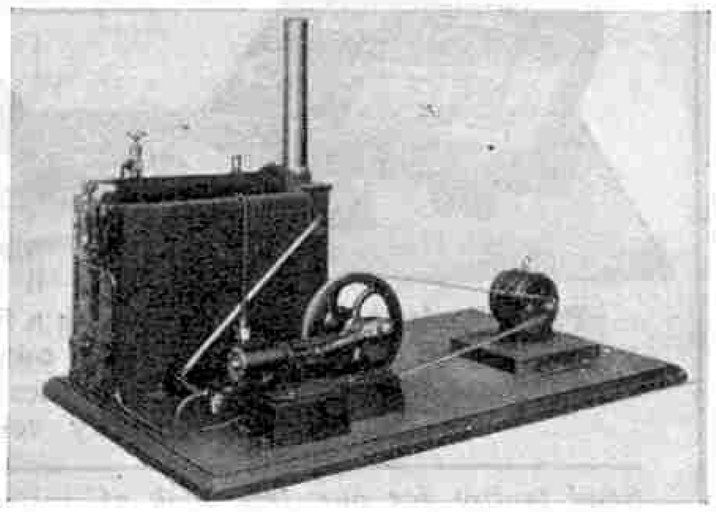

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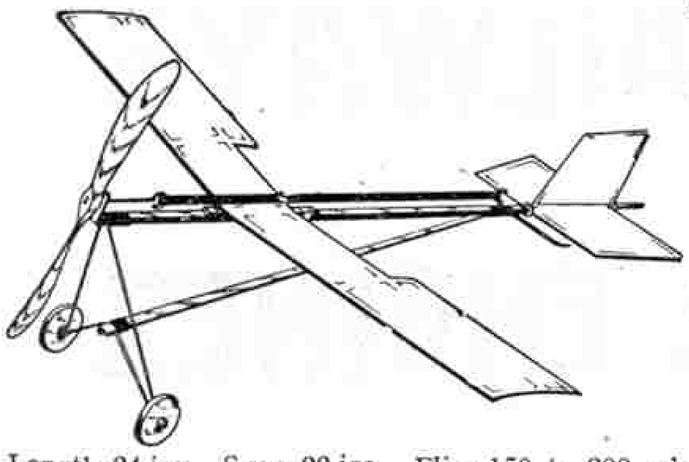

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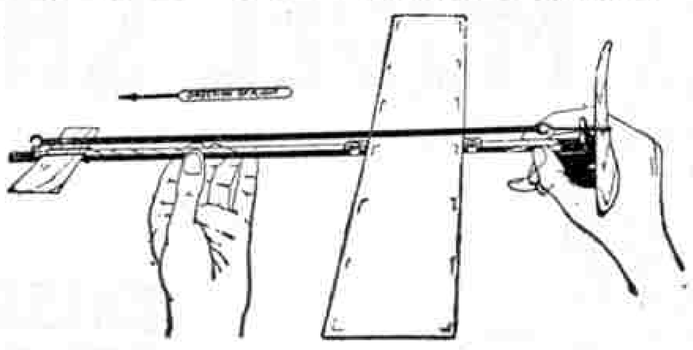

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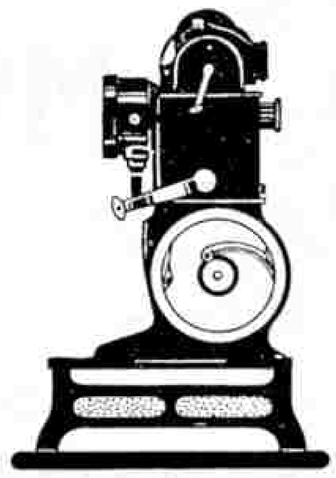

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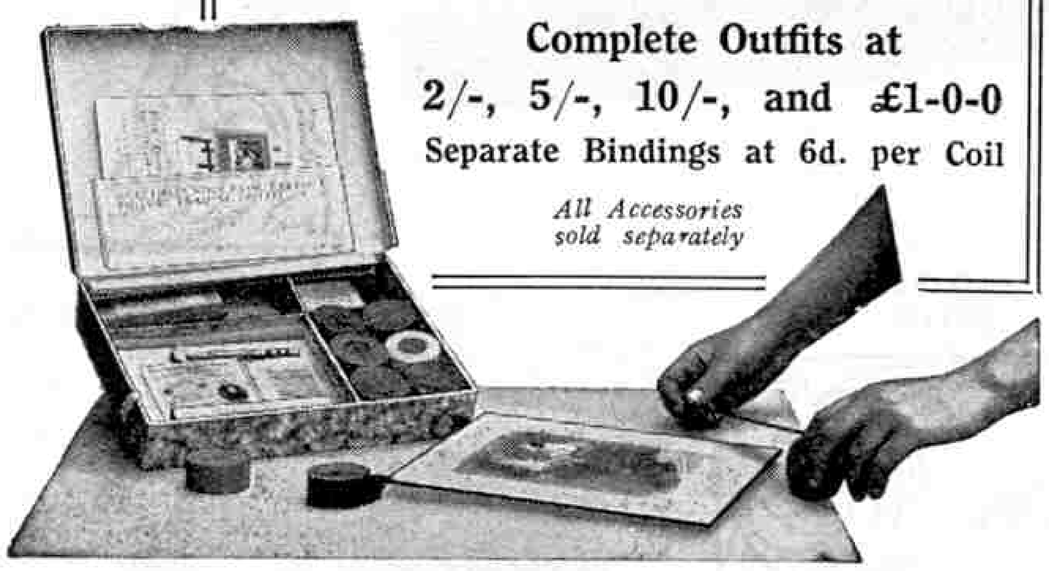

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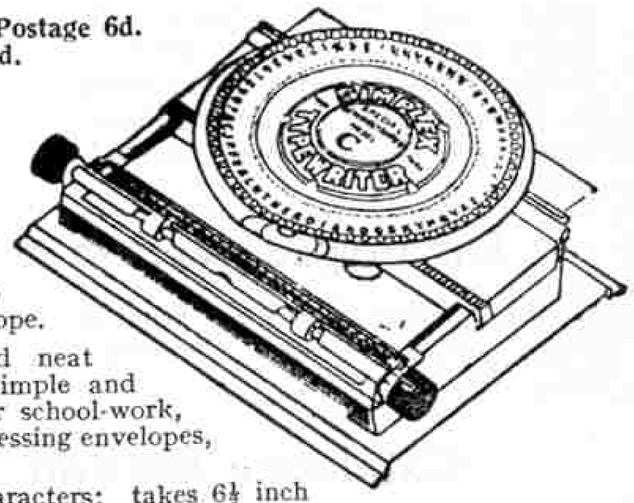

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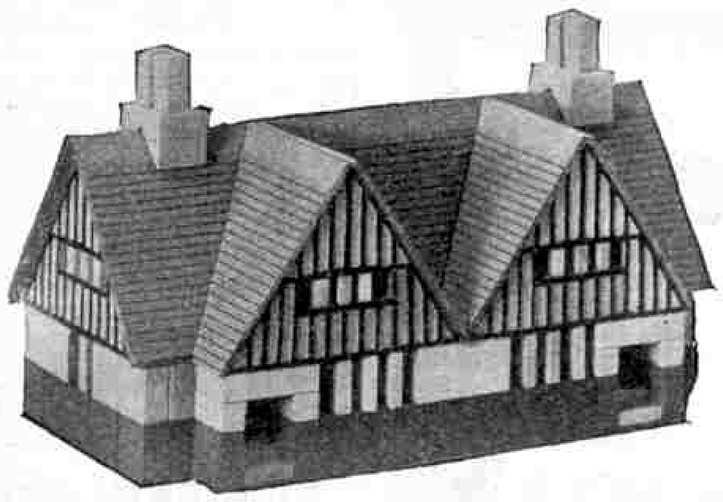

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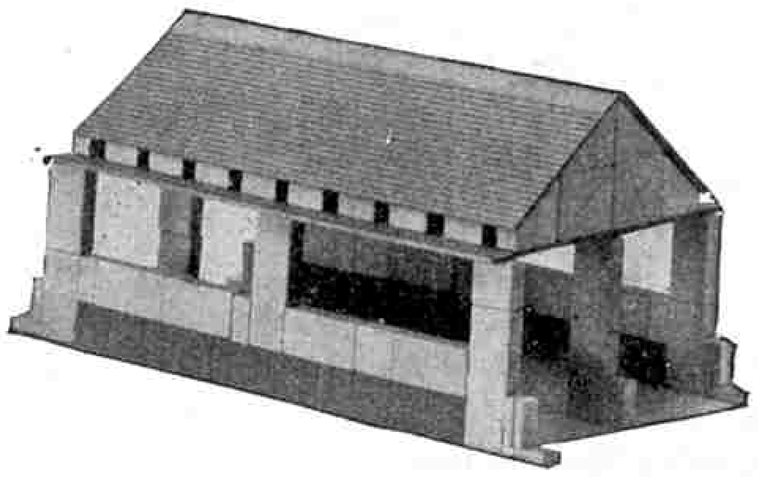

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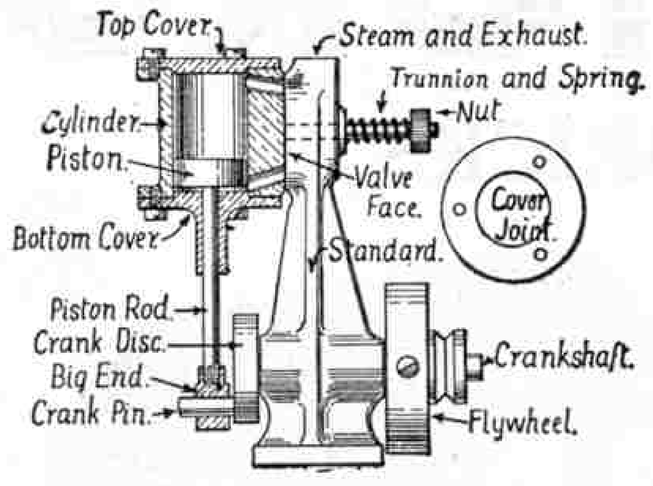
,, – – – Central Educational Co. Ltd.
,, – – – Ratcliffes Toyeries.
Dumfries – – Robert Elder.
Eastbourne – – Dale & Kerley Ltd.
,, – – – Hamleys Ltd.
,, – – – Bobby & Co.
,, – – – J. E. Beale Ltd.
Edinburgh – – Jenners Ltd.
,, – – R. Maule & Son Ltd.
,, – – Thornton & Co. Ltd.
Exeter – – – J. Webber & Son.
Glasgow – – R. Wylie Hill & Co. Ltd.
Glasgow – – Rowans Ltd.
,, – – Andersons Royal Polytechnic Ltd.
,, – – Lumleys Ltd.
Gloucester – – Bon Marche Ltd.
Gravesend – – Penlerick & Hunwick.
Hanley, Staffs. – John Pepper's Stores.
,, – – Huntbachs Ltd.
Harrogate – – E. & M. Smart.
Hastings – – H. A. Jepson Ltd.
Hertford – – Pratt's
Huddersfield – – Rushworths Ltd.
Hull – – – Ye Olde Toy Shoppe.
Inverness – – Walkers Emporium.
Ilkley, Yorks. – – G. Broadbent.
Ipswich – – – W. S. Cowell Ltd.
King's Lynn – – W. H. Smith & Son.
Kilmarnock – – H. Lauder & Co. Ltd.
Leeds – – – The Pygmalion.
,, – – – B. & I. West.
Leicester – – Robothams Ltd.
,, – – – James McRobie Ltd.
Liverpool – – Lewis's Ltd.
,, – – Bon Marche Ltd.
,, – – Bunneys Ltd.
Lowestoft – – Spashett & Co.
Leamington Spa – Burgis & Colbourne.
Middlesbrough – H. Binns, Son & Co. Ltd.
,, – R. Scupham & Sons.
Manchester – – Lewis's Ltd.
,, – – H. Wiles Ltd.
,, – – John Heywood Ltd.
,, – – A. M. Barr.
Maidstone – – W. E. Thorpe & Son.
Motherwell, N.B. – John Baillie Ltd.
Nottingham – – Pearson & Pearson.
,, – – Redmayne & Todd Ltd.
Northampton – – Slades Stores.
Northwich – – W. Barnes & Son.
Newcastle-on-Tyne – James Coxon & Co. Ltd.
Newport, I.O.W. – Frank R. Morgan.
Norwich – – Jarrold & Son Ltd.
,, – – Langley & Co.
Perth – – – Joe Anderson.
Portsmouth – – Landport Drapery Bazaar Ltd
,, – – J. H. Hargreaves & Son.
,, – – James Watkins & Son.
Plymouth – – Spooner & Co. Ltd.
Preston – – – Merigold Bros.
Reading – – E. Hill & Sons.
Rotherham – – W. Cooper.
Sheffield – – John Walsh Ltd.
,, – – Cole Bros. Ltd.
,, – – T. & J. R. Roberts Ltd.
,, – – Wilson Gumpert & Co. Ltd.
Shrewsbury – – R. Mansell & Son.
,, – – Della Porta & Son.
Southsea – – Handleys Ltd.
,, – – A. H. Bull Ltd.
Southport – – Edward Davies.
Sunderland – – H. Binns, Son & Co. Ltd.
South Shields – – H. Binns, Son & Co. Ltd.
St. Annes-on-Sea – A. V. Worder.
St. Helens – – Ben Brooks.
Southampton – – McIlroy Ltd.
Swansea – – Ben Evans & Co. Ltd.
Stourbridge – – L. N. Shaw.
Stockton – – Darnbrough & Son.
,, – – Wanless Bros.
Stafford – – W. H. Smith & Son.
Stoke-on-Trent – Wayte Bros.
Swindon – – S. Goldsmith.
,, – – Tompkins & Barrett.
Tunbridge Wells – Porters.
Wakefield – – Eagle Press Ltd.
Warrington – – W. Hodgkinson Ltd.
Wolverhampton – James Beattie & Co. Ltd.
,, – – Harris Bradley.
Worcester – – Sime's.
Yarmouth – – Arnolds Ltd.
,, – – R. J. Ward.
York – – – Leak & Thorp Ltd.
Belfast, Ireland – Anderson McAuley Ltd.
Cork – – – F. H. Woollan.
Dublin – – – Hely's Ltd.
,, – – Grafton Street Bazaar.

LOTT'S BRICKS LTD., WATFORD, ENGLAND

You must have the S.T. ENGINE

to drive your Meccano Models.



This is the drawing which helps you to build the engine.

S.T. Engine Parts	... ...	5/–
Finished Boiler	... ...	8/–
Finished Plant on Base	...	17/6

Post Free.

It is utterly different from the ordinary Toy Shop model engine.

In the first place you have the pleasure of building it yourself.

You need have no fear, we **guarantee** it will work when you have built it.

Secondly, like all Stuart models it is made on correct engineering lines and therefore has **Power.**

The Boiler is of Copper, brazed throughout and tested.

Read what another customer writes :—

"I may say that my S.T. engine has been in service for over two years now and has never given any trouble. Its power is amazing. With a reduction ratio of 15 to 1, it will drive a wheeled vehicle weighing more than 10 lbs."

Send a stamp for list 12M which describes this and several other simple models, or better still a Postal Order for 6d. for our new 80 page

"ENGINE CATALOGUE,"

fully illustrated and packed with interest from cover to cover.

Stuart Turner Ltd., Henley-on-Thames

A SOUND INVESTMENT

The New Moving Coil Loud Speaker

All parts to make up this marvellous Sound reproducer now in stock.

GET READY FOR THE CHRISTMAS PARTY

by electrifying your Gramophone. All makes of pick-ups now in stock. Igranic 37/6. Burne Jones 35/–. Brown £4, etc., etc.

What about a New Receiving Set for Christmas either as a present for a friend or for your own use at home? Two, three, four or five valve MARCONI SETS SUPPLIED ON THE HIRE PURCHASE SYSTEM. Write in for leaflet giving all particulars and secure one of these most efficient sets before the holidays.

AN IDEAL CHRISTMAS PRESENT

Only a few left. AMPLIFEX LOOP AERIALS. The most efficient loop yet devised. To clear 30/–. Brownie Crystal Set, Headphones and Aerial, 27/6.

OUR NEW CATALOGUE IS NOW READY

Send to-day for your copy—66 pages profusely illustrated with all the latest wireless components. Price 6d. to defray postage and packing. CALLERS FREE.

Telephone : Regent 4577.

WILL DAY, LTD.

THE BEST IN THE WEST

19, Lisle St., Leicester Square

LONDON, W.C.2

Telegrams : "Titles, Westrand, London."

Riley's Home Billiards banish winter evening dulness from 100,000 homes!

Riley's "Home" Billiard Table shown resting on ordinary Dining Table.

Write to-night for Free Coloured Price List.

Instal a Riley Billiard Table in your home, it will provide great enjoyment **DOWN** during the winter evenings and will last a lifetime.

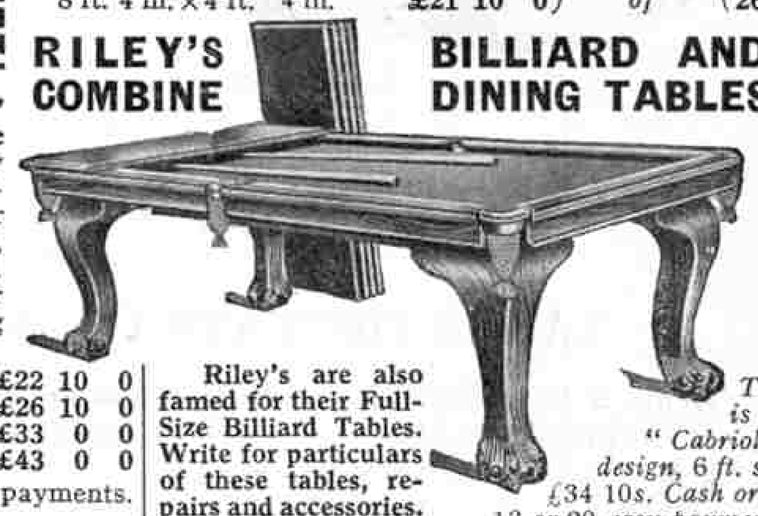
14/-

Send **14/-** to-night to Riley's. They will immediately despatch the 6 ft. size **Home Billiard Table** to rest on any ordinary dining table. If the 6 ft. size is not suitable for your home you will find a convenient size among the following :—

4 ft. 4 in. × 2 ft. 4 in.	£7 0 0	*or in*	18 *monthly payments of*	8/6
5 ft. 4 in. × 2 ft. 10 in.	£9 0 0			11/–
6 ft. 4 in. × 3 ft. 4 in.	£11 15 0			14/–
7 ft. 4 in. × 3 ft. 10 in.	£15 0 0			18/–
8 ft. 4 in. × 4 ft. 4 in.	£21 10 0			26/–

7 DAYS' FREE TRIAL GIVEN.
Carriage paid and all risk in transit taken by Riley's.

RILEY'S COMBINE BILLIARD AND DINING TABLES



Riley's "Combine" Billiard and Dining Table is a beautiful and highly finished piece of furniture. Supplied in Oak or Mahogany, any shade, and in various designs. These prices are for Mahogany Round Leg Design.

5 ft. 4 in. × 2 ft. 10 in.	£22 10 0
6 ft. 4 in. × 3 ft. 4 in.	£26 10 0
7 ft. 4 in. × 3 ft. 10 in.	£33 0 0
8 ft. 4 in. × 4 ft. 4 in.	£43 0 0

or in 13 or 20 monthly payments.

Riley's are also famed for their Full-Size Billiard Tables. Write for particulars of these tables, repairs and accessories.

This is the "Cabriole" design, 6 ft. size £34 10s. Cash or in 13 or 20 easy payments.

E. J. RILEY LTD., DEAL WORKS, ACCRINGTON

and Dept. U, 147, Aldersgate Street, London, E.C.1

SOMETHING NEW FOR XMAS

THIS new outfit of Harbutt's Plasticine is undoubtedly one of the most Fascinating Hobbies. Anyone can start to design. The various patterns you can make are *infinite*—No two need ever be alike—You can make designs for Needlework, Wood Carving, Stencils, Picture Frames, Leatherwork, Embossing, Friezes, Dados, Cushions, Dresses or Hats. A well illustrated book with every outfit gives full instructions.

Price 5/6; post free 6/3 in Great Britain.

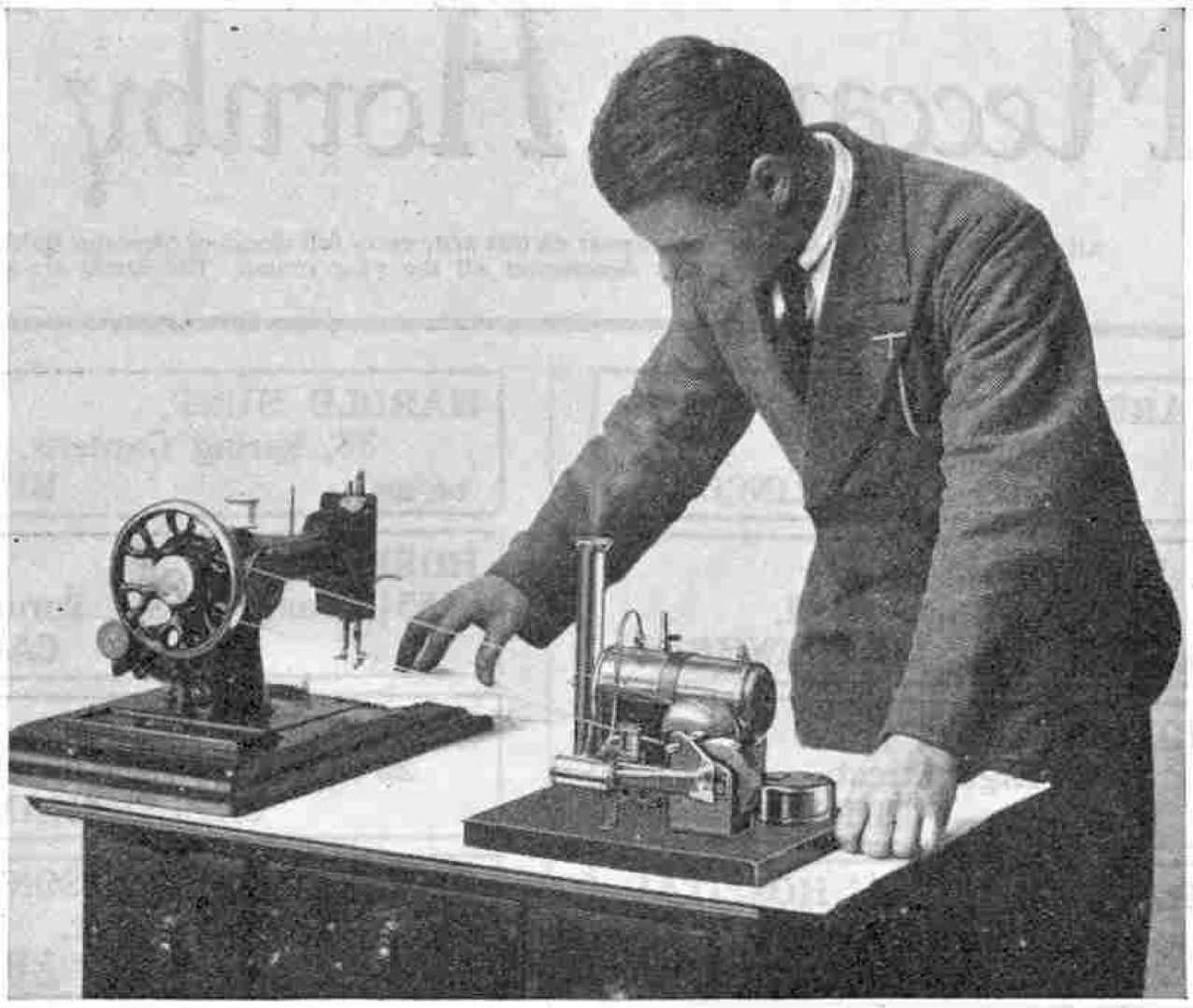
HARBUTT'S PLASTICINE LTD.

99, BATHAMPTON, BATH

The Greatest Xmas You Ever Had

A guaranteed British made steam engine that will develop enough power to turn a sewing machine, or lift 9 lbs. dead weight.

An engine that will "rev" at 30 revolutions a second, and will run for 1½ hrs. with one filling.



Our famous Model E.101 turning a Sewing Machine

That is what this wonderful model will do, think of it and compare it with any so-called "steam engine" of Continental manufacture at double the price.

Made of steel and polished brass, it has a solid brass flywheel 1" thick and actually weighing 1 lb. Every other part is massive and in proportion. An automatic adjustable drip feed lubricator is fitted, just like a proper power plant. It is a real engineering job.

Ask Your Dealer to Show You this Wonderful Model

Mounted on a heavy bed 11" × 9" × 1" thick, height of the funnel from the bed 9". Cylinder 1" stroke, the boiler highly polished brass, large capacity, 6" long, 3" diameter, and fitted with excellent whistle and safety valve. Engine provided with two speeds. Total weight of engine over 7 lbs.

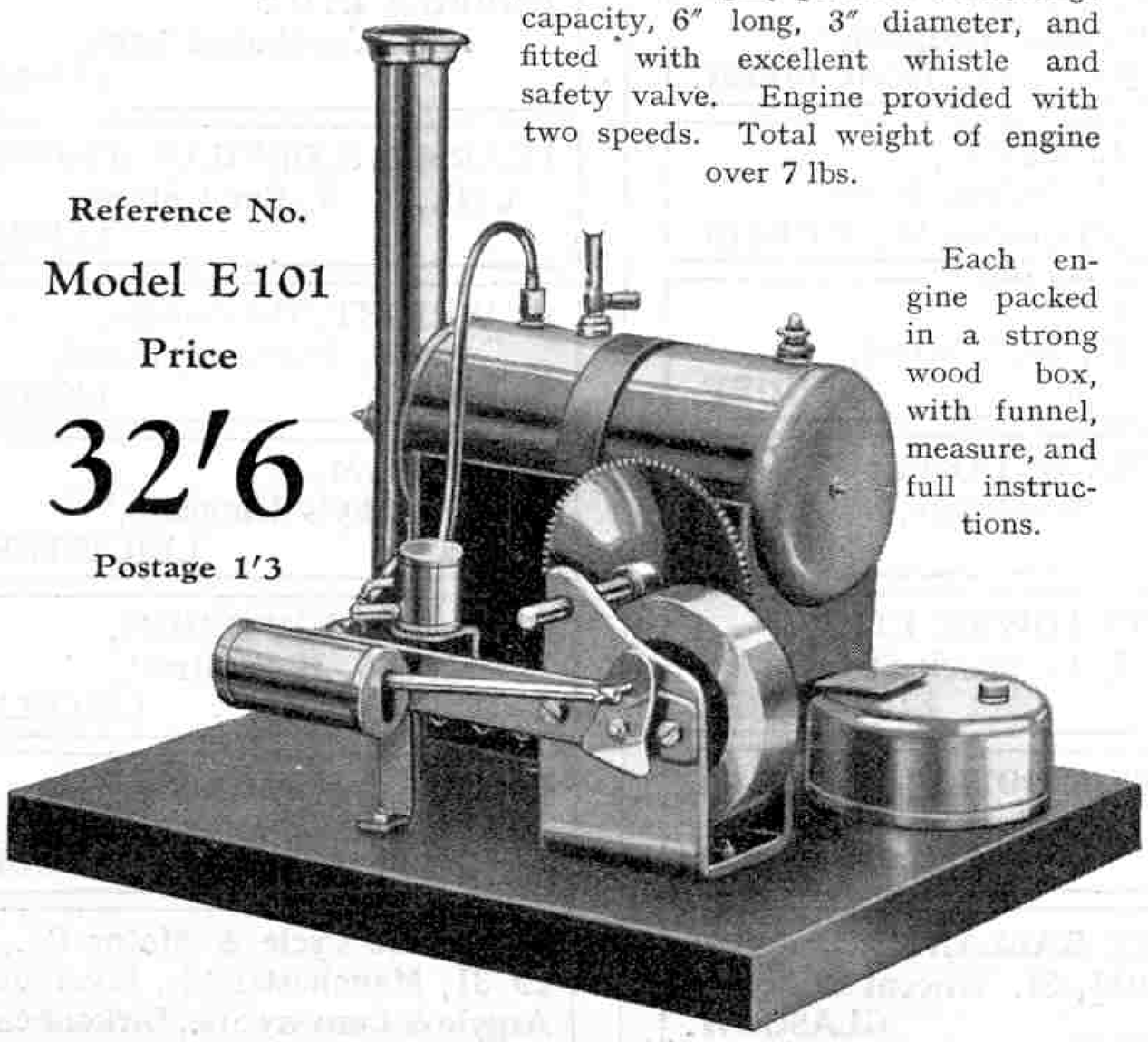
Reference No.

Model E 101

Price

32'6

Postage 1'3



Each engine packed in a strong wood box, with funnel, measure, and full instructions.

It will turn a sewing machine.

It will drive several Meccano models at once, the end of the gear wheel shaft being turned down to take Meccano size pulleys and chain sprockets, etc.

It will drive Hobbies fretwork models.

It will work a crane and lift 9 lbs. dead weight.

It will work a dynamo.

BOWMAN MODELS DEREHAM NORFOLK

Obtainable at all of Hobbies branches and high class dealers everywhere. If unable to obtain send direct to us together with your dealers' name and address.

Bowman Models

DEREHAM NORFOLK

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this page carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

J. WOODHALL,
256, Grange Road,
'Phone : B'head 621 **BIRKENHEAD.**

HOBBIES LTD.,
9a, High Street,
BIRMINGHAM.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
BLACKPOOL.

SELLEN'S BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

J. MORRIS, F.C.O.,
70, Knowsley Street,
Tel. 1074 **BOLTON.**

BROWN, MUFF & CO. LTD.,
BRADFORD.

HOBBIES LTD.,
68, London Road,
BRIGHTON.

JOHN TAYLOR,
28, Preston Street,
Tel. : Brighton 957 **BRIGHTON**

BRISTOL TOY EXCHANGE,
92b, Whiteladies Road,
Clifton, **BRISTOL.**

GYLES BROS. LTD.,
Tel. 2888 24, Bridge Street, **BRISTOL.**
188, Whiteladies Road, Clifton, **BRISTOL.**
Tel. 143

JOHN HALL (TOOLS) LTD.,
BRISTOL. **NEWPORT.**
CARDIFF. **SWANSEA.**

SALANSON LTD.,
20, High Street, **BRISTOL.**
4, High Street, **CARDIFF.**

SAM TAYLOR,
Silver Street,
Tel. 320 **BURY.**

HAROLD HUNT,
38, Spring Gardens,
Tel. 202 **BUXTON.**

HOBBIES LTD.,
385½, Yonge Street, Toronto 2,
CANADA.

H. W. GILL,
23 & 24, Pittville Street,
CHELTENHAM SPA.

THOMAS JAMES & SON,
High Street,
CINDERFORD.

R. H. JEPSON,
1, Cross Cheaping,
COVENTRY.

PURSEY & MOCKRIDGE,
The Sports Outfitters,
Tel. Dartford 173 **DARTFORD.**

HENRY WHALLEY,
195, Duckworth Street,
DARWEN.

RATCLIFFES TOYERIES,
19, Osmaston Road,
DERBY.

C. E. MELLER,
"Dolls' Hospital,"
55, Hall Gate, **DONCASTER.**

JAMES L. DIXON,
14, Suffolk Street,
(off Grafton St.), **DUBLIN.**

DIXON'S,
41, High Street,
DUNDEE.

DRAFFEN & JARVIE LTD.,
Nethergate,
DUNDEE.

BASSETT-LOWKE LTD.,
5, Frederick Street,
EDINBURGH.

WRIGHT'S DOLLS' HOSPITAL,
14, High Street,
ERDINGTON.

ROBERT BALLANTINE,
103½, St. Vincent Street,
GLASGOW.

C. BELL (The Children's House),
320, Byres Road, Hillhead,
GLASGOW, W.2.

CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, **GLASGOW.**
Model Makers to the Admiralty, the Railway Coys., etc.

HOBBIES LTD.,
326, Argyle Street,
GLASGOW.

The MARVEL MART (Wm. Ross & Co.)
110, West Nile Street,
GLASGOW.

FLETCHER'S TOYLAND,
77, Deardengate, **HASLINGDEN.**
Grand Building, **RAWTENSTALL.**

GAMLEYS,
The Hove Hornby Train Store,
78, Church Road, **HOVE.**

HAMMOND'S LTD.,
Paragon Square,
HULL.

W. J. S. CARPENTER,
13 & 15, Queen Victoria Street,
LEEDS.

HOBBIES LTD.,
89a, Woodhouse Lane,
LEEDS.

PEARSON & DENHAM (PHOTO) LTD., 6, Bond Street,
LEEDS.

A. WRIGHT, The Garage,
200/2, Dewsbury Road,
Tel. 22719 **LEEDS.**

ROBOTHAM,
"Baby's Kingdom,"
Tel. 4809 **LEICESTER.**

BYCROFTS EMPORIUM,
366, High Street,
LINCOLN.

C. LUCAS, Hobbies Depôt,
35, Manchester Street,
LIVERPOOL.

Reliance Cycle & Motor Co.,
29/31, Manchester St., Liverpool.
Argyle & Conway Sts., Birkenhead.

Meccano & Hornby Train Supplies

The thirty-three dealers whose advertisements appear on this page carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

The ARUNDEL CYCLE & SPORTS STORE, 52, Church Road, Upper Norwood, LONDON, S.E.19.

HOBBIES LTD.,
65, New Oxford Street,
Tel. Mus. 1656 LONDON, W.C.

HOBBIES LTD.,
147, Bishopsgate,
Tel. London Wall 7350 LONDON, E.C.

HOBBIES LTD.,
79, Walworth Road,
Tel. Central 2457 LONDON, S.E.

W. HUMPHRYS & SON,
269/271, Rye Lane,
Estab. in 1840 PECKHAM, S.E.15.

LEDWITH BROS.,
42 & 44, Walworth Road,
Nr. ELEPHANT AND CASTLE, LONDON, S.E.17.

F. R. POTTER & SON,
43, Market Place,
LOUGHBOROUGH.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

BARRS, Children's Paradise,
49, Deansgate,
Telephone 165 City. MANCHESTER.

A. FRANKS LTD.,
95 & 97, Deansgate, MANCHESTER.
90, Bradshawgate, BOLTON.

HENRY'S Toy & Game Stores,
22, King Street,
Tel. 3004 Central MANCHESTER.

HOBBIES LTD.,
10a, Piccadilly,
MANCHESTER.

A. INMAN, MANCHESTER.
105, Lapwing Lane, Didsbury. Tel. 1518.
179, Dickenson Rd., Rusholme. Tel. 2241.

JOHN NESBITT LTD.,
42, Market Street,
MANCHESTER.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

R. SCUPHAM & SONS,
35, Linthorpe Road,
MIDDLESBROUGH.

WILLIAM OLLIFF,
13, Grainger Street West,
NEWCASTLE-ON-TYNE.

W. MARK & CO. LTD.,
27, The Drapery,
NORTHAMPTON.

J. R. NORRIS,
Photographic Dealer,
9, Pelham Street, NOTTINGHAM.

JANES & ADAMS,
13, The Promenade,
And Branches. PALMERS GREEN.

DEAN & HOLT,
78, Yorkshire Street,
ROCHDALE.

ROCHESTER.
GERALD MORRIS,
24, High St., ROCHESTER.

A. E. HAIG,
16, Northenden Road,
SALE, CHESHIRE.

HOBBIES LTD.,
214, West Street,
SHEFFIELD.

THE REDGATE CO.
(SHEFFIELD) LTD.,
Tel. 22806 Moorhead, SHEFFIELD.

SHEFFIELD PHOTO COMPANY,
6, Norfolk Row (Fargate),
'Phone 23891 SHEFFIELD.

WILSON, GUMPERT & CO. LTD.,
57, Fargate,
Tel. 489 SHEFFIELD.

BIRMINGHAM & COVENTRY CYCLE CO., 140 & 151, Above Bar,
SOUTHAMPTON.

HOBBIES LTD.,
25, Bernard Street,
SOUTHAMPTON.

OSBORN & CO.,
9, High Street,
SOUTHAMPTON.

S. T. SIMPSON & SON,
589-595, Lord Street,
Tel. 999 SOUTHPORT.

H. W. GINN,
The London Motor, Cycle & Sports Co.,
Tel. 252 Staines 106, High St., STAINES.

SPORTS HOUSE WOKING & WEYBRIDGE.

Don't Lose Your Possessions

Put Your Initials on Them

The Boys' Complete Transfer Outfit

Mark your **Cycle, Camera, Suit Case, Fishing Tackle and all you value** with your own Initials.

Six Sets Initials in Black and Gold Material and Full Instructions to Fix.

1/6 Post Free. Six extra Sets Initials **6d.**

J. W. TAYLOR,
447, Reddings Lane, Hall Green, Birmingham.

BOYS—GREAT OFFER !
COMPRESSED AIR ENGINES.

Great Speed. No Cost. No Danger.
Suitable for working small models. It can be unscrewed from the base and fitted to a boat, aeroplane, etc. Charged with compressed air by an ordinary cycle pump.
Well finished. Excellent value.
Price 4/6.

H. J. MALLETT, E. Dereham, Norfolk.

1/6 THE BULLY BOY 1/6

20-Shot Rapid Repeater Action Pea Pistol. Fires a pea 25 feet at the rate of 100 a minute. A regular Pocket Lewis Gun ! Bright nickel finish ; each in box with ammunition. A better shooter than you have ever had before ! Send **1/6** and don't miss our latest quick-firer !
Colonial Orders 9d. extra.

J. Bishop & Co. (Dept. 3), 41, Finsbury Sq., London, E.C.

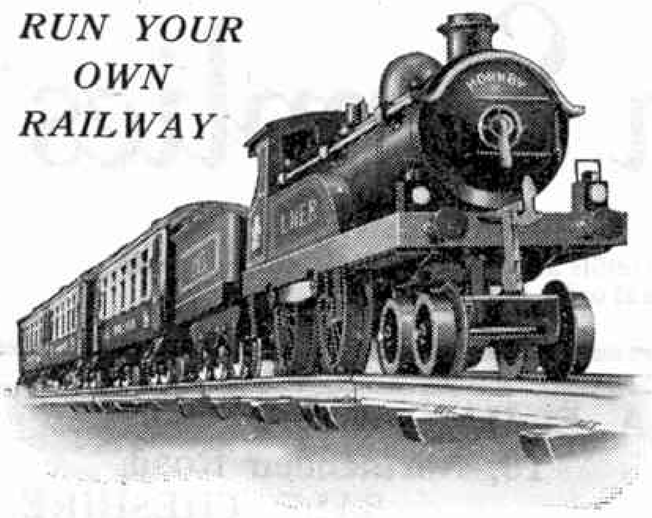
Scale Model Railways

We supply Locomotives of all types, coaches, wagons, track, accessories and parts, etc., for all gauges and at most reasonable prices.

Our ILLUSTRATED CATALOGUE gives full particulars of our products, and a copy will be sent post free for 6d.

The Meersbrook Model Company,
Dept. M.2,
Cliffe Field Road, SHEFFIELD.

RUN YOUR OWN RAILWAY



BOYS! You cannot afford to miss our Xmas Display. See the Working Meccano Model and the Trains disappearing through the Tunnel.

Bring your Fathers. We have the Stocks.

HORNBY TRAINS

Meccano Outfits and Parts

Agent or Bassett-Lowke Model Railways. Catalogue 6d. each. Also Leeds Model Co. Trains and Accessories. Catalogue 1/- each.

HOBBIES STEAM LAUNCHES.

Arundel Cycle Stores,

52, Church Road,
Upper Norwood,

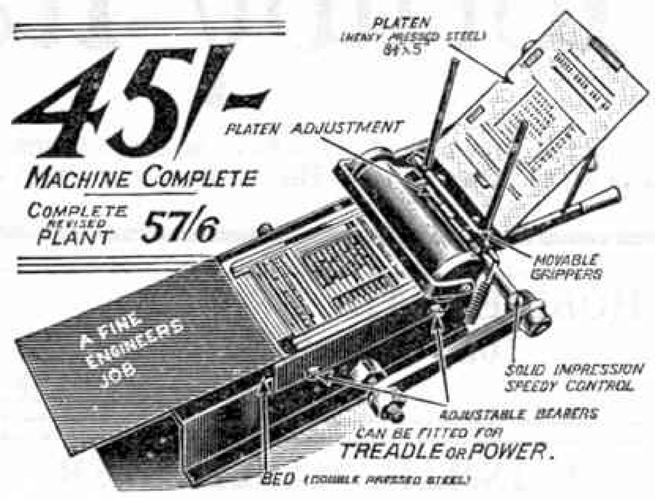
LONDON, S.E.

Tel.: Sydenham 2482.

ADANA AUTOMATIC SELF-INKING

PRINTING MACHINE

NEW ALL-STEEL SUPER-MODEL



The Machine that is Built from the experience of over 10,000 Users of the old Model.

This all-steel Machine is a fine piece of engineering. Nearly 15,000 users of Adana Printing Plants, saving enormously in their own work, and hundreds making an excellent living. Will print any matter from

Chemist's Label to an Illustrated Magazine

at a really commercial speed, including Perforating, Creasing and Box-making. Only finest materials used in its construction. Simplicity to the extreme, no special skill required. Large numbers of boys producing school and scout magazines. Real Printers' metal type, case, complete accessories and fully illustrated instruction book included in plant. Two-coloured illustrated particulars and samples of work sent on receipt of stamped addressed envelope.

This model is designed for commercial use in all large and small printing establishments.

Machines can be shipped abroad C.O.D. cash against documents in London. Goods F.O.R. Twickenham.

THE ADANA AGENCY

is a complete organization for the supply of Printing Office Equipment of every description for the small working Printer and Business House Printing Dept. Controlled by most highly skilled and long experienced men of the Printing world, having expert technical knowledge of every part of Letterpress Printing.

(Dept. MM/1), 17, Church Street, Twickenham.

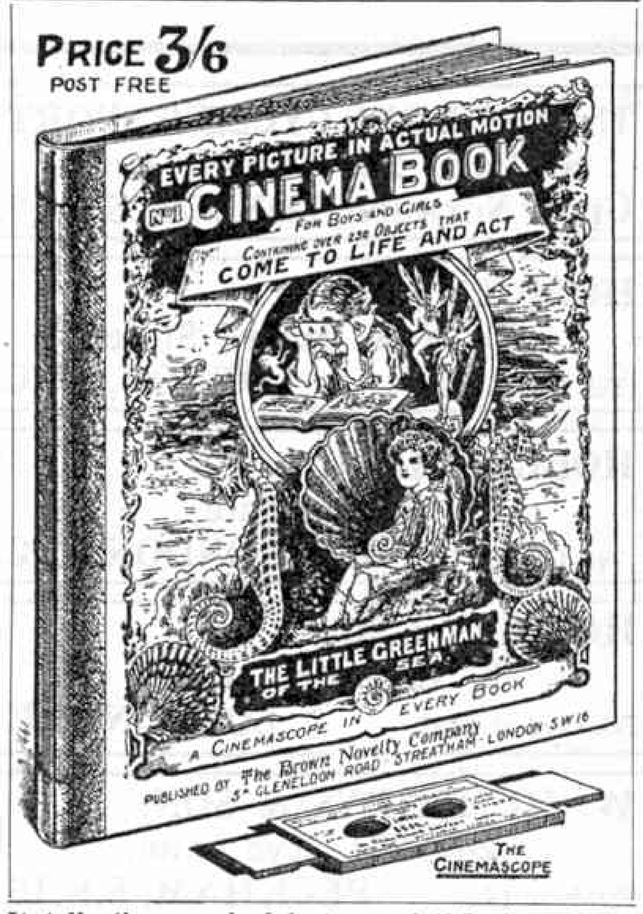
BOYS! It is simply Top Hole!

The

CINEMA BOOK

Containing over 250 objects that COME TO LIFE AND MOVE. The Super-Novelty of the Year.

PRICE 3/6
POST FREE



It tells the wonderful story of "Jack and the Little Green Man of the Sea," and every Picture is a "Movie."

This is what the "English Mechanic" says about it:—

"It contains a practically inexhaustible source from which to obtain entertainment."

Send P.O. for 3/6 direct to:—

THE BROWN NOVELTY CO.

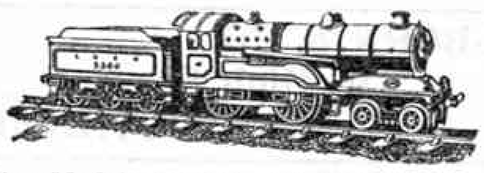
5a, Gleneldon Road, Streatham,

London, S.W. 16

and the CINEMA BOOK will be sent by return of post to any address within the U.K. Abroad 6d. extra.

NOTE.—Clever boys and girls who can draw may earn pocket-money by sending in sketches for future issues of the Cinema Book. For particulars see Cinema Book.

Please mention "Meccano Mag."



Our Fine Model of the L. & N.E.R. "Director" Class Locomotive.
Gauge 0. Electric or Clockwork.

This is only one of many beautiful Models which we offer. Parts and Fittings for Home Construction a speciality.

The LEEDS MODEL Co. Ltd.,
Dept. M., BALM ROAD, HUNSLET, LEEDS.

The Hall-mark of Quality

L·M·C *Accurate to Scale Perfect in Detail*

CATALOGUE, with particulars of our new 7/6 MODELS of G.W. and S.R. COACHES, Corridor or Suburban. 1/- Post Free.

Railway Postcards. Real Photographs. 3/6 per dozen. Selections on approval.—N. Embley, Warton St., Lytham

Aldis Ensign High-speed Vertical Enlarger. Model V3. Latest Pattern. New and unused. Cost £8 13s. What offers.—Box 1201.

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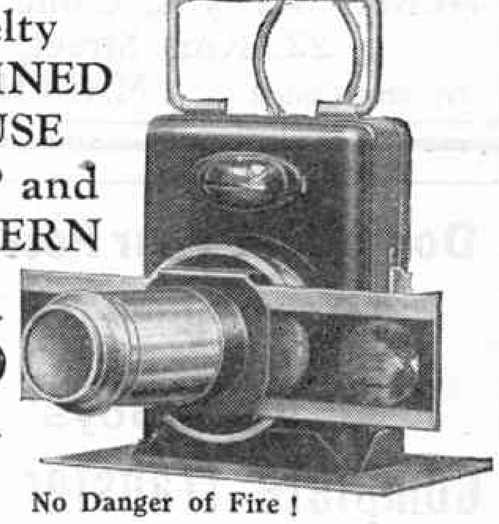

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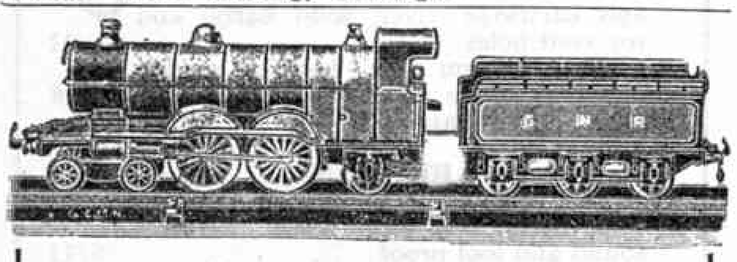

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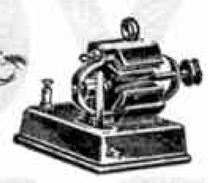

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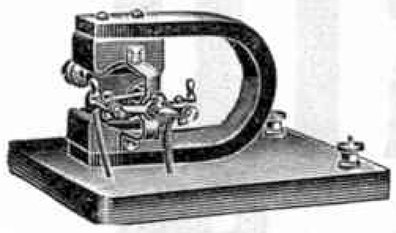

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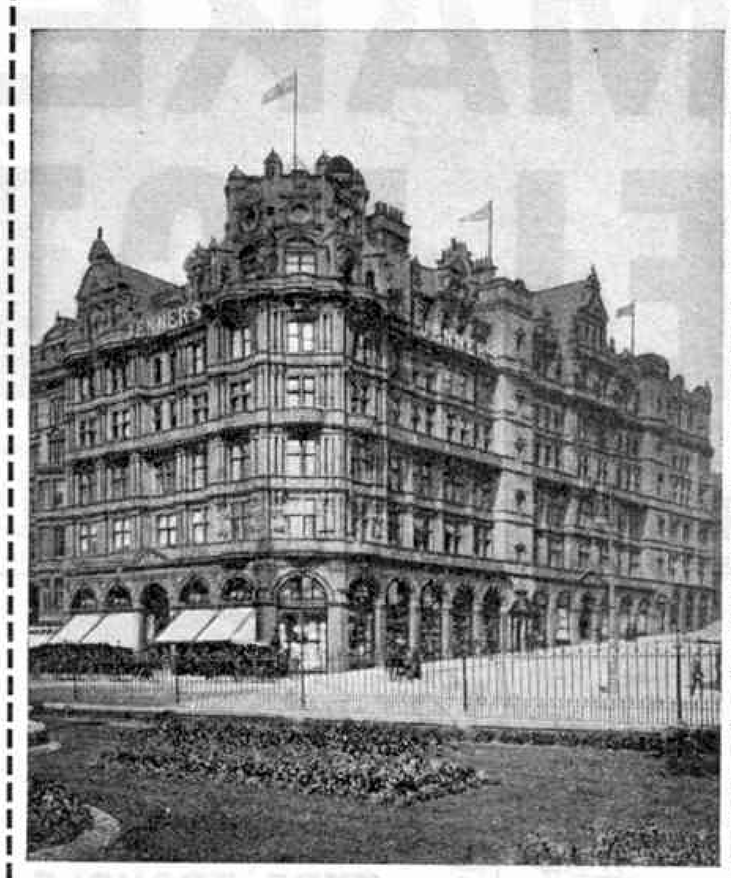

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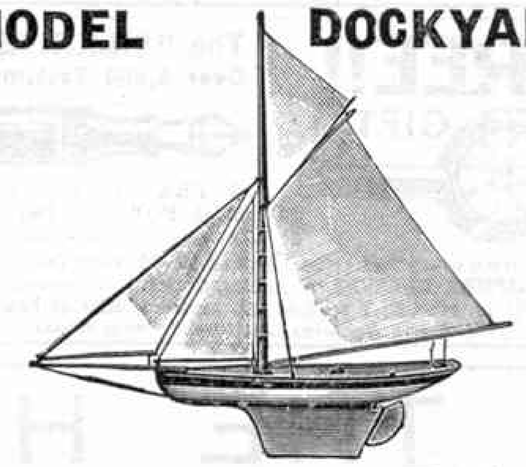

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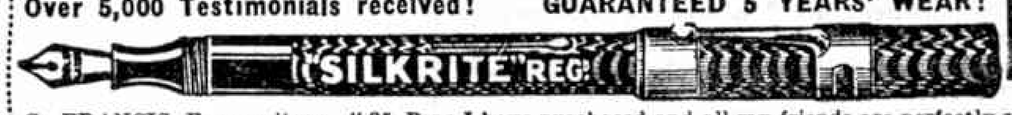

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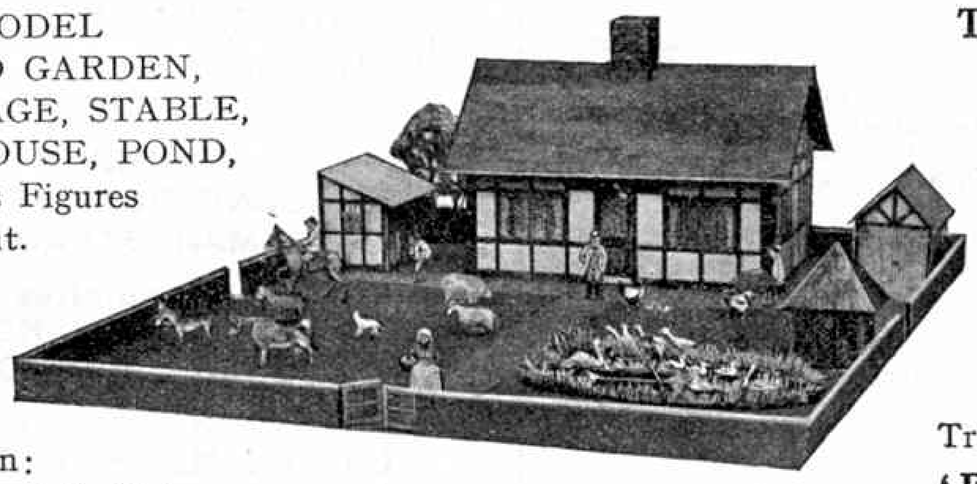

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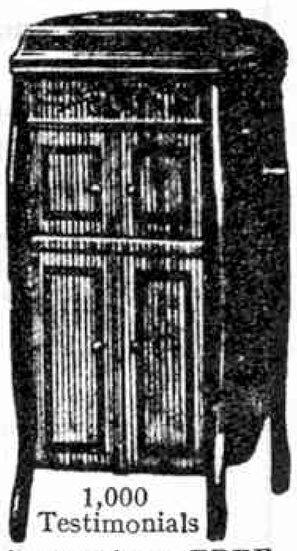

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(*Continued from page* 1105)

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Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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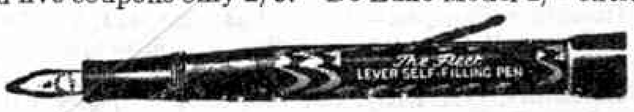

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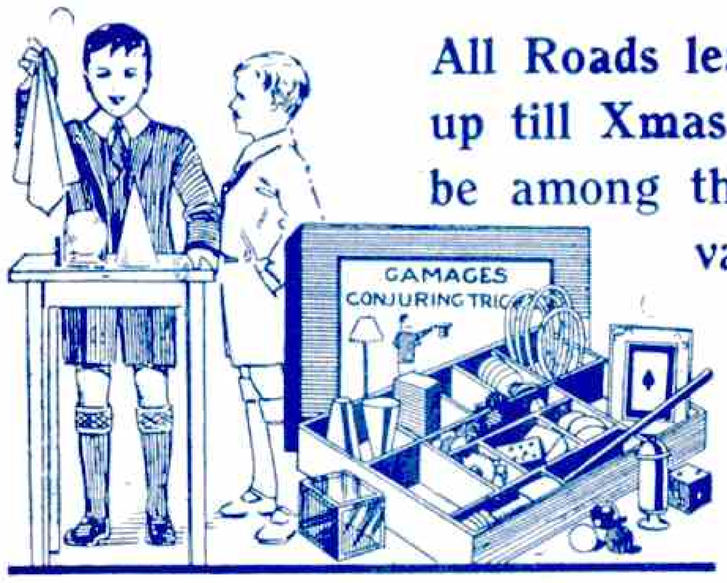

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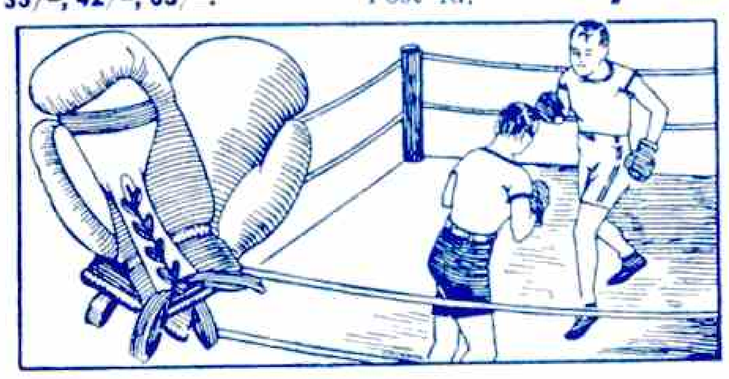

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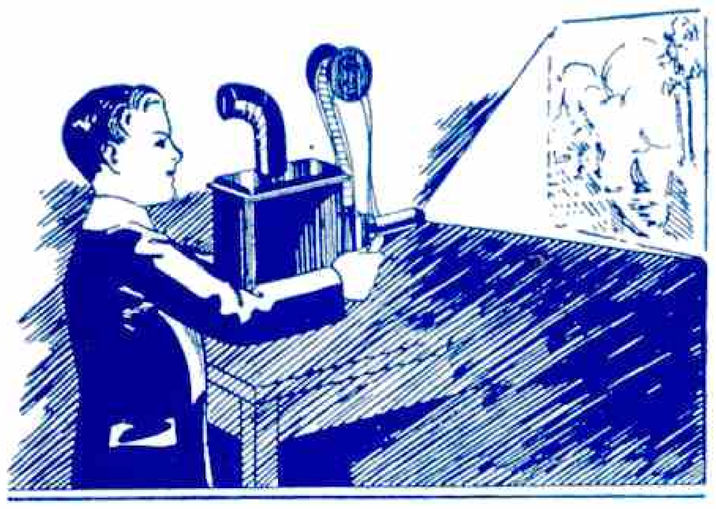

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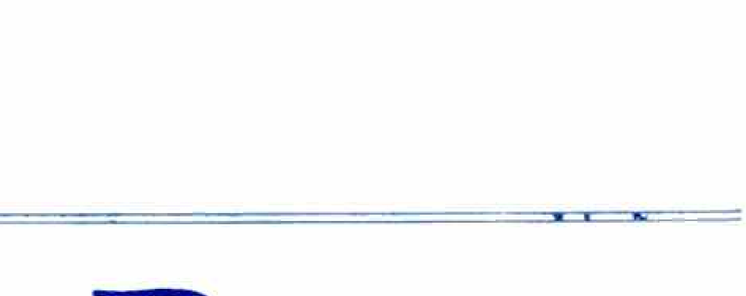

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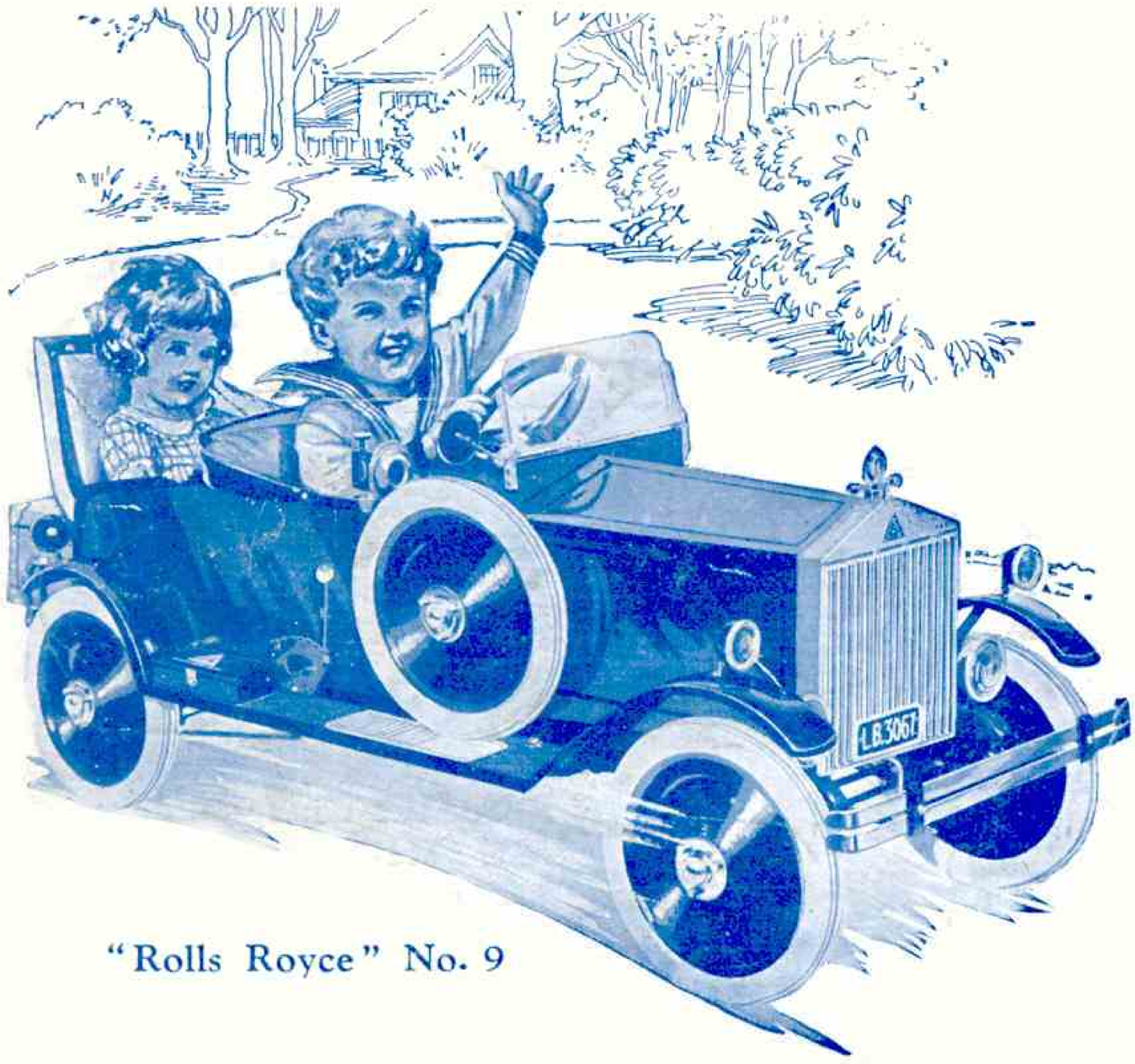

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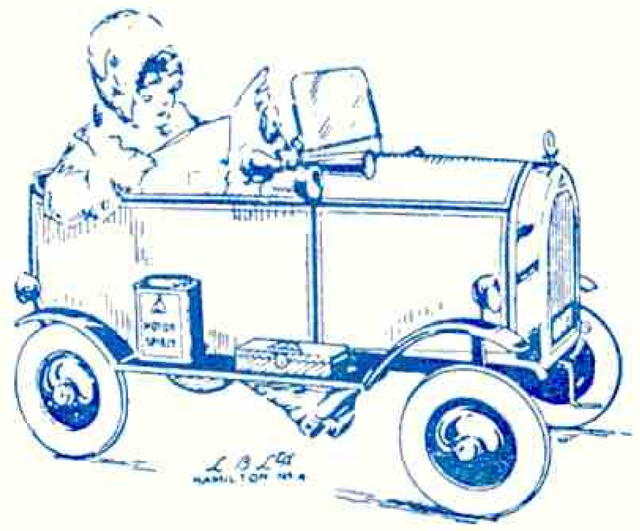

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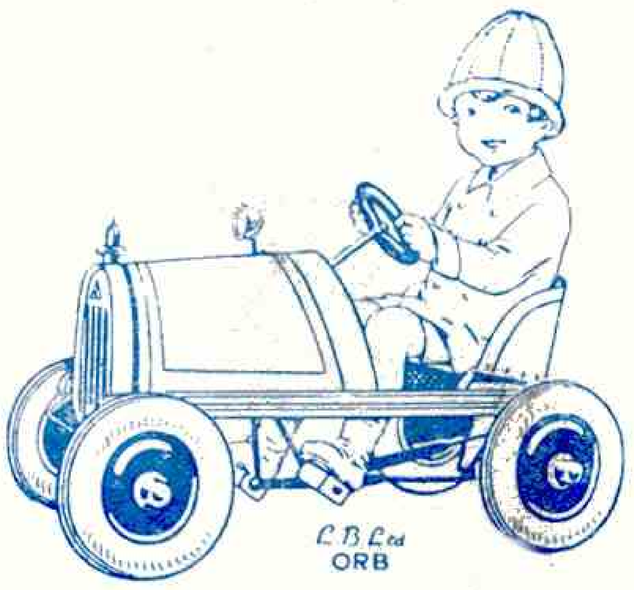

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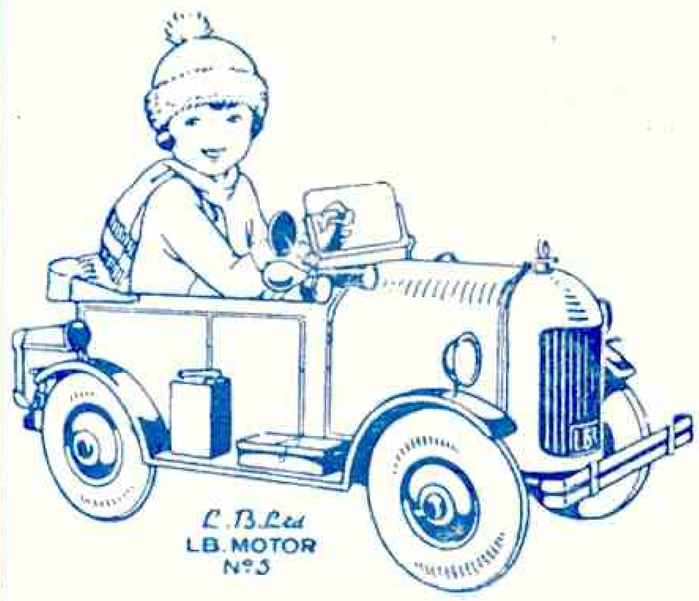

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